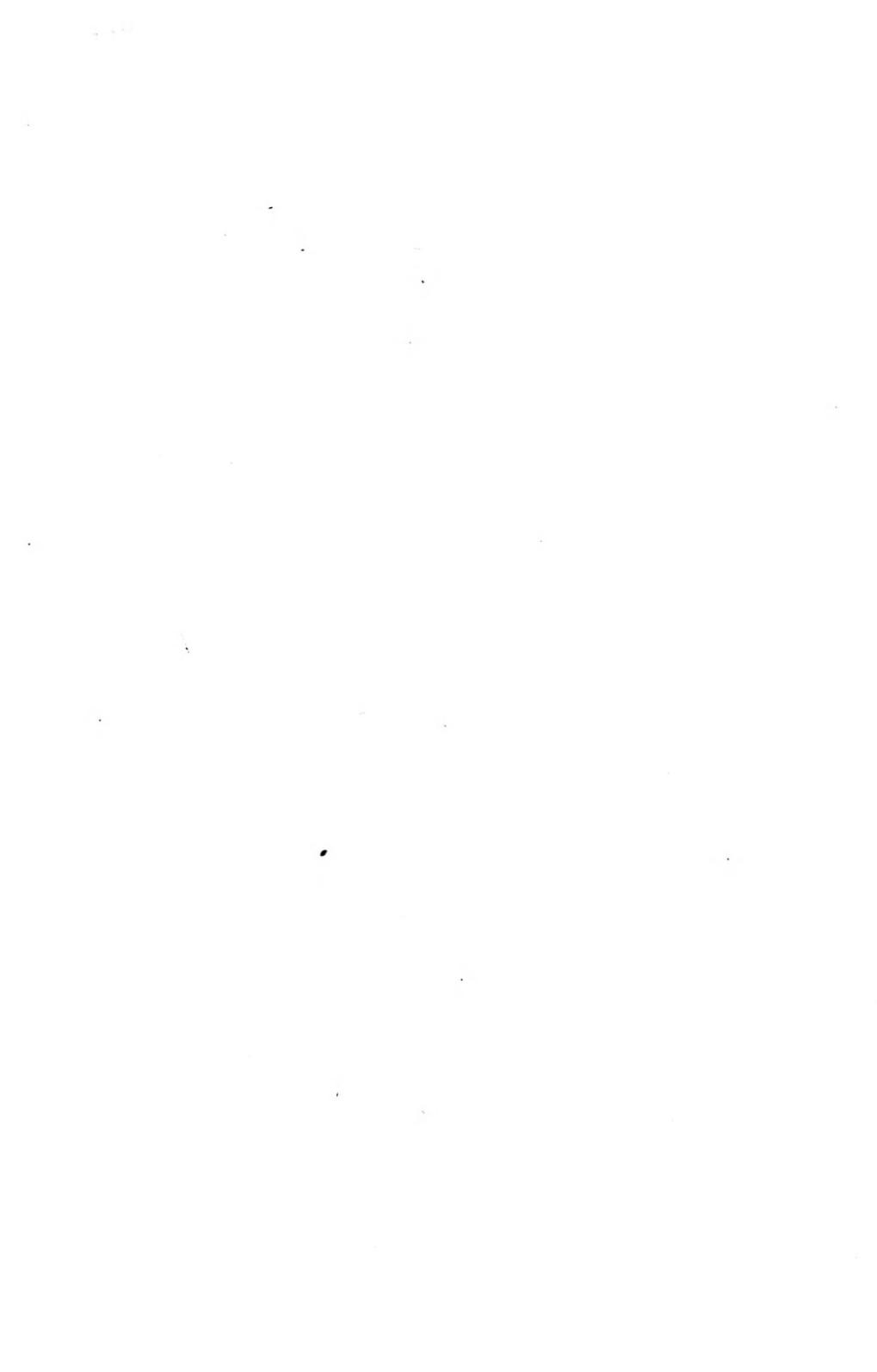
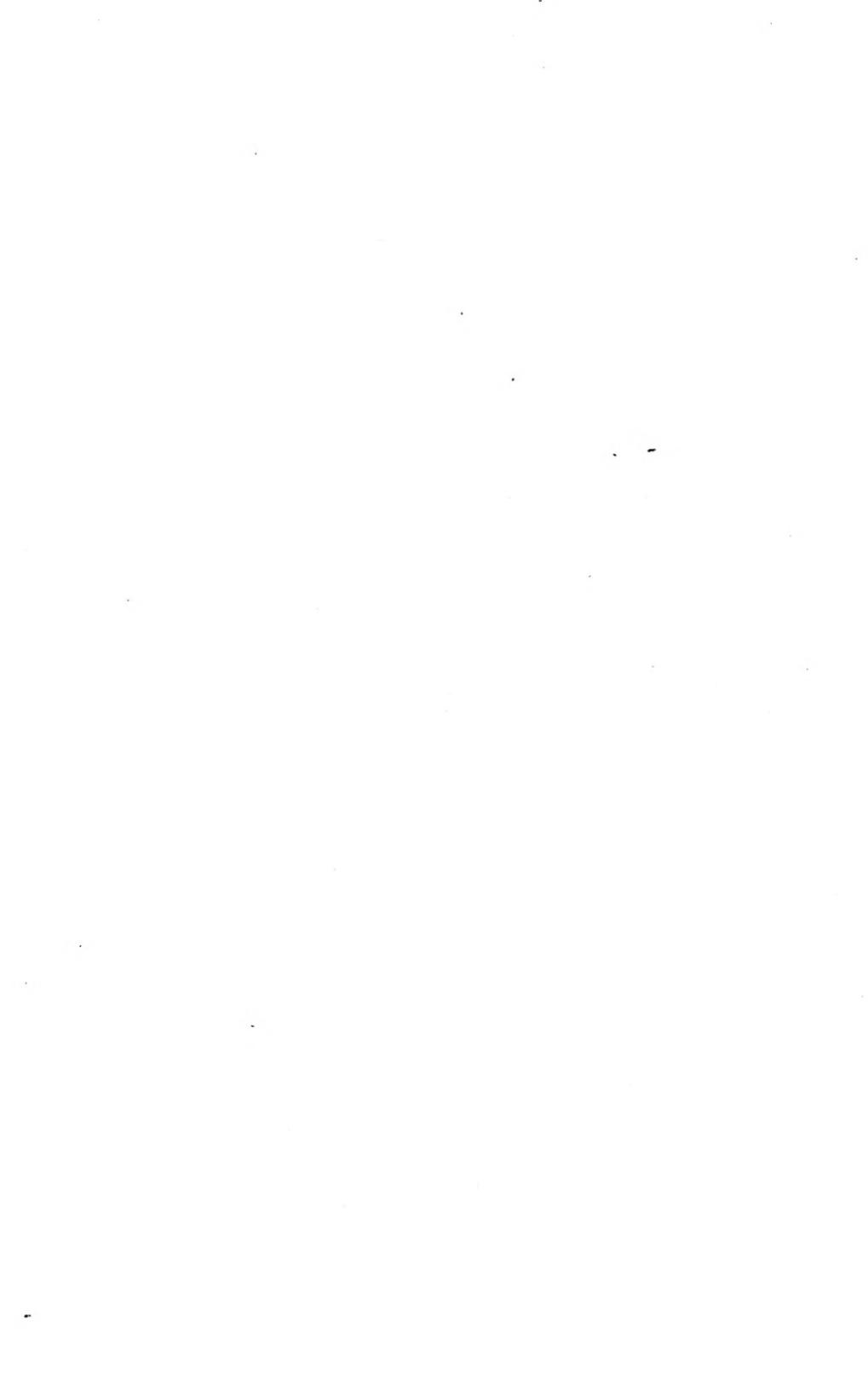


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EDITORIAL NOTICE.

The **Archives of Ophthalmology** is a bi-monthly journal, published in annual volumes of about six hundred pages each, extensively illustrated with cuts in the text, half-tone text plates, and lithographic plates, many in colors.

About three quarters of the space is devoted to original papers, and the remaining quarter to a systematic report on the progress of ophthalmology, and to reports of societies, book reviews, and miscellaneous notes, all of it original.

The papers and reports are original, and only accepted with the understanding that they are to be published in this journal exclusively. The original papers in the English edition appear in the German (*Archiv für Augenheilkunde*) either in full or in more or less abridged translations, and *vice versa*. Any subscriber who wishes to refer to the original text of a translated or abridged paper may, by applying to the editors, obtain a reprint which he is expected to return after perusal. The subscription price of the ARCHIVES OF OPHTHALMOLOGY is \$6.00 per year payable in advance. The price per number is \$1.00.

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ARCHIVES OF OPHTHALMOLOGY.

DOUBLE LUXATION OF THE EYEBALLS IN A CASE OF EXOPHTHALMIC GOITER.

BY DR. WALTER R. PARKER, DETROIT, MICHIGAN.

(*With two illustrations on Text-Plate I.*)

A. K., male, aged sixty years. German. Patient entered the Ophthalmic Clinic of the University of Michigan January 5, 1921. Family and previous personal histories were negative. The date of the onset of his present disease was indefinite. He had noticed a bulging of his eyes for several months, and had been very nervous at times. Seven weeks before the time of admission to the hospital he had observed a marked increase in the bulging of his eyes, followed by rapid failure of vision, with resulting blindness one week before admission. Up to the time of the marked bulging of his eyes his occupation consisted in lifting bags of coal from a conveyor belt to trucks. The weight of each bag was from 80 to 100 pounds and he lifted about three hundred each day.

Examination.—The patient was undernourished and obviously under weight. He had general weakness, tachycardia, tremor, and moist skin. Blood Wassermann, 1 +. X-ray examination, including the sinuses, was negative. Oral examination showed no foci of infection. The medical report was in effect that the patient had all the symptoms of hyperthyroidism. Basal metabolism—first test, 50% over normal; second test, 76% over normal.

V.R.E., light perception; L.E., nil. Both eyes were luxated, the lids being partially closed back of the equator of the globe. Ocular movements were present in all directions, though somewhat limited in degree. The lids were flaccid and could be easily separated from the globe. There was present a marked exposure chemosis in the portion of the

globe not covered by the lids, and a slight mucopurulent discharge covered both eyes. The entire cornea in each eye was infiltrated and oedematous, and a large central ulcer was present in both eyes. The cornea of the left eye had perforated. The ophthalmometer reading was: right eye, 24 mm.; left eye, 23 mm. Bacteriologic examination, staphylococcus albus.

Treatment consisted of rest in bed and high caloric diet. Enucleation of the left eye was advised, but permission was refused by the patient. The ulcers were treated with silver and argyrol. The discharge disappeared in about two weeks, in which time an attempt was made to reduce the proptosis by pressure. The cornea was smeared with vaseline, a rubber protective placed over the eye, and a bandage applied. In six weeks' time the proptosis had improved to such a degree that the lids could be closed over the eyeball. The patient's general condition so improved that after two and one half months' stay in the hospital he had gained 25 pounds in weight and the proptosis had so diminished the lids could be closed.

Fig. 1 is a reproduction of a photograph of the patient on admission to the hospital, and Fig. 2 shows how he appeared two and one half months later.

Luxation of the eyeball is of rare occurrence in exophthalmic goiter. While it is only an incident in the course of the disease, the treatment must be immediate and drastic or the effect on the vision may be most disastrous.

Our knowledge of the aetiology of the cardinal symptoms of exophthalmic goiter is still too indefinite to permit of more than conjecture in regard to the causes of the disease. But, assuming that congestion of the blood-vessels plays a part in the exophthalmos, it may not be unreasonable to suggest that the lifting of three hundred eighty-pound weights each day, as in the case reported, was one of the contributing factors in the causation of the extreme exophthalmos.

Treatment.—The general treatment of Graves's disease will not be considered at this time.

In regard to the local treatment that may be employed in these rare cases of extreme proptosis, I can merely offer suggestions resulting from the experience in the case reported and from information acquired from a somewhat incomplete review of the literature.

The treatment has included the use of the Buller shield,

uniting the conjunctiva over the cornea; tarsorrhaphy alone, or in combination with canthoplasty or slitting the upper and lower lids, or with the removal of a considerable amount of fat from the orbit.

Mr. F. A. Juler¹ reported a case of purulent keratitis treated by tarsorrhaphy, resections of the cervical sympathetic, and X-ray. One eye was lost, but vision of $\frac{1}{2}$ was preserved in the other. When the patient, a woman aged thirty-six years, came under observation, there was extreme exophthalmos, hypopyon, and suppurative keratitis in one eye, while in the other the exophthalmos was not so marked and there were no inflammatory symptoms present. The right eye was removed after panophthalmitis developed. The cornea in the left eye became roughened, conjunctiva congested, and movement limited. The external canthus was divided, and tarsorrhaphy performed after slitting the lids. The lids separated after the fourth day. One week later the cervical sympathetic was resected, the cornea covered with conjunctiva, and the lids were again united. After ten days the lids again separated. Mattress sutures were then introduced, but they also failed to hold, and the cornea became infected. Later canthotomy was performed and conjunctivoplasty repeated. The lids remained closed ten days, the cornea healed, and no further ulceration occurred. Final vision, $\frac{6}{2}$.

Mr. Coulter, in discussing Mr. Juler's paper, reported the history of a case in which one eye was lost. As soon as the second eye showed signs of corneal involvement a tarsorrhaphy was performed and the lids were kept closed for months. Recovery with good vision. In the same discussion Mr. Paton referred to a case in which both eyes were lost in spite of the fact that a tarsorrhaphy was attempted three times. Each time the stitch pulled out. Von Poppen² reported a history in which the exophthalmos was extreme. He divided the outer canthus, but did not do a tarsorrhaphy. Both eyes were lost. Knapp succeeded in preserving the vision by suturing the lids, after making incisions after the manner of Harman. Sattler³ referred to 40 cases of corneal involvement in exophthalmic

¹ *Trans. Oph. Soc. U. K.*, 1913.

² *Deutsch. med. Woch.*, xxxvi.

³ *Graefe-Saemisch Handb.*

goiter in which both eyes were lost; 9 cases had complete loss of vision in one eye and partial loss in the other; and 14 cases had complete opacity in one eye. While this list is in no way complete in regard to the number of cases reported, it is sufficient to indicate that the salvation of the cornea rests in some form of mechanical protection.

In order that the lids may be more firmly united, two suggestions have been made—one by Mr. Bishop Harman, namely, that in order to relieve the tension on the lids, a wide incision be made through the skin in the upper lid just below the brow, in the lower lid just above the orbital margin. The raw surfaces present no difficulty, as the skin can be reunited if the expedient is temporary, or grafted, if permanent. Another mode of procedure is suggested by Foster Moore.¹ He successfully closed the lids in a case of extreme exophthalmos in Graves's disease by first removing a large amount of fat from the orbit through an incision made in the inferior fornix. While this procedure seems somewhat drastic, it appeals to the author as one that might well be employed in this group of serious cases.

¹ *Lancet*, 1920.

THE RELATION OF HEADACHE TO FUNCTIONAL MONOCULARITY.¹

BY DR. ALBERT C. SNELL, ROCHESTER, N. Y.

(*With graph on Text-Plate II.*)

HEADACHE is indisputably the most common symptom for the relief of which patients consult the ophthalmologist. Snydacker found that in 2000 consecutive patients $\frac{2}{5}$ or 40% complained of headache. Brav in 3000 consecutive cases found that 30% asked relief from headache, there being no other symptoms. Approximately three out of every four of our patients (excluding those with acute inflammatory conditions) complain of headache or give a history of having had headache in some form. Yet there are many patients who rather surprise us by stating that they do not have, or that they never have had headache. Volumes have been written about headache, especially that associated with eye strain or some form of ocular maladjustment, but scarcely anything has been said about the acephalalgic patient. Therefore I trust that the statistics which I herewith present may have some scientific value and interest. This paper is the study of one thousand ten cases of partial or of complete functional monocular, and the relation of such conditions to the prevalence of headache.

When one considers the class of cases which are relatively less subject to headache, it seems to be quite universally accepted that the higher degrees of hypermetropia are less likely to cause asthenopic symptoms than the lower or the intermediate degrees; and that myopia, corrected and uncorrected, is less likely to cause headache than hypermetropia. One author presents these observations by saying, "Poor vision excludes

¹ Read at the meeting of the American Ophthalmological Society, Swampscott, June 14, 1921.

eye-strain." The question of the prevalence of headache among the blind has been studied by Walton who found that 66% of persons blind from infancy were free from headache. Later he investigated the frequency of migrainous headache among the blind and found it only one-half as frequent among the blind as among seeing persons of like age and conditions.

Several years ago I was impressed with the fact that many patients with only one useful eye often gave a history of the absence of headache. A search through the literature revealed only a few references relative to this observation. I found the unique and well-known case of Dr. Noyes in which the removal of a nearly normal eye, having standard vision, afforded complete relief to a patient who had suffered for years almost constant "agonizing headache" and other asthenopic symptoms. Ranney states that "a typical cross-eye is not, as a rule, the cause of serious nervous disturbance.... Eye-strain is practically absent in extremely cross-eyed subjects." Wilder in writing of the visual standards in the army states that persons with congenital amblyopic eyes are "seldom annoyed by asthenopia, if the fellow eye has fairly good vision and no great refractive error, for they do not have binocular single vision." Oliver in the chapter on ametropia in Norris and Oliver's "System of Diseases of the Eye" says: "Were the human eye cyclopic, the problem (asthenopia) would be easier of solution, and eye-strain would be less disastrous in its consequences." Donders (*Accommodation and Refraction of the Eye*, p. 415) as early as 1864 made the observation that asthenopia was overcome by strabismus convergens or divergens, and expressed the fact in the following striking antitheses:—

"Hypermetropia causes accommodative asthenopia, to be actively overcome by strabismus convergens.

"Myopia leads to muscular asthenopia, passively yielding to strabismus divergens."

Although all of these references indicate at least a mitigation of asthenopic symptoms in proportion to the loss or absence of single binocular vision, I could find no reference to any statistics to substantiate these opinions or my own belief that the monocular are comparatively free from headache.

Therefore I have undertaken a study of a series of cases falling within the class of the functioning monocular believing that such a study would be interesting and would shed some light on this subject. I have taken from my files 1010 cases having different degrees of monocularity and have tabulated them. In the tabulation I have recorded for each patient, the age, occupation, refraction, visual acuity, muscle balance, condition of general health, and the presence or absence of headache or head-pain. For simplicity, the cephalgias were divided into two classes only, the severe or habitual, and the mild or occasional.

In selecting the cases for tabulation the following were excluded: cases under fifteen years of age; cases in which the vision of the better eye was less than $\frac{1}{2}\%$, and those clearly showing the presence of some active local or constitutional disease. In excluding persons under 15 years of age we felt that prior to this age a sufficient period of time should not have elapsed to establish the fact of the presence or absence of habitual headache; that the personal history of these patients in regard to headache would often be unreliable; and further, that prior to fifteen, especially with girls, many other factors incident to the beginning of adolescence enter in the aetiology of headache. Only those cases in which there was present a central visual acuity of $\frac{3}{4}\%$ or $\frac{3}{5}\%$ in the better eye were used, as a perfect, or nearly perfect vision in one eye was desirable in considering monocularity. The visual test was recorded and considered with the use of glasses when the patient was wearing them, and without glasses when the patient was not using them. The reason for excluding those with active constitutional or local ocular diseases is self-evident, as such conditions would have a direct relationship to the presence of headache.

Considering the different degrees of disturbances of binocular single vision the cases seemed rather naturally to fall into the following four groups: I. The one-eyed; II. The anisometropic; III. The amblyopic; IV. The strabismic. The first group contains all those cases which had lost one eye, considering only those in which the monocularity had existed for five years or more, and those having only one good eye, the other eye having an acuity of less than $\frac{1}{25}\%$; the second group includes those cases of anisometropia in which binocular single vision

was not present or in actual use, also a limited number of cases presenting a very marked dominance of one eye although in these latter cases single binocular vision was present and visual acuity was standard in each eye; the third group includes all cases of monocular amblyopia; the fourth group includes all cases of strabismus both convergent and divergent, constant or intermittent.

TABLE SHOWING THE NUMBER OF CASES AND THE PERCENTAGE OF HEADACHE

<i>Group</i>	<i>Kind or Degree of Monocularity</i>	<i>Total Number of Cases</i>	<i>Number Without Headache</i>	<i>Number Having Habitual Headache</i>	<i>Number Having Occasional Headache</i>	<i>Total Number Without Headache</i>	<i>Percentage of Headache</i>
B	Binocular	1010	298	606	106	712	70
I	One eyed or Absolute monocularity	96	88	2	6	8	8.3
II	Anisometropia or Suppressed monocularity	120	105	5	7	15	11.4
III	Amblyopia or relative monocularity	546	436	44	66	110	20.1
IV	Strabismus or Functional monocularity	248	192	24	32	56	22.6
Total for Groups I, II, III, and IV		1010	821	75	111	189	18.7

Group I. Complete monocularity. In this group there are 96 cases. Of these, 30 had been blind in one eye for five to twenty years; 40 had been blind in one eye for twenty to thirty years; and 26 had been blind for forty years or more. Headache of a severe or habitual type was found in only two cases. One case had suffered headache for a period of 20 years, and the other for 45 years. Six cases gave a history of an occasional or mild headache. Therefore only 2% of the absolute monocular patients showed habitual or severe headache, and 6.2% occasional or mild headache, or a total of 8.3% having any form of headache. In this group there were eight cases which

gave a history of severe or habitual headache before losing an eye, and a complete absence of all headache after the loss of an eye.

Group II. Anisometropia or suppressed monocularity. In this group are included two classes of cases: first, those of unequal vision (anisopia) due to a high degree of anisometropia so that only one eye was functioning with good central visual acuity; while the other, although having a possible standard visual acuity with proper glasses, did not or could not adapt itself to the use of the correction for that eye having the greater refractive error. Generally there was a difference in the spherical correction of the two eyes of more than four diopters. Second, those with one very dominant eye but with equal vision (isopia), the monocular dominance being determined by the winking test of Rider and because of an habitual desire or habit almost constantly to close one and the same eye.

In this group there are 120 cases of which 93 had anisopia and 27 isopia. Of the former 5 or 5.3% had severe or habitual headache, and 6 or 6.4% occasional or mild headache; and of the latter none had severe or habitual headache and 1 or 4% had mild or occasional headache. Taking the group as a whole and including both classes of headache, the total percentage of headache was found to be 11.4%.

In three of the cases of anisometropia a persistent attempt had been made to use correcting glasses, but these always caused the recurrence of severe headache. Without the glasses or with only the better eye corrected, these patients were perfectly comfortable and free from headache.

Group III. Amblyopia or relative monocularity. This group includes all cases of monocular amblyopia. These cases were divided into four classes depending on the visual acuity of the amblyopic eye. The best vision with correcting glasses was taken in every case and the question of cephalalgia was considered with the use of correcting glasses. In each class are included all cases with vision in the amblyopic eye as follows: (Vision in the nonamblyopic eye with glasses being $\frac{3}{2}\frac{1}{2}$ or better) Class A, $\frac{3}{2}\frac{1}{2}-\frac{4}{3}\frac{1}{3}$; class B, $\frac{2}{3}\frac{1}{3}-\frac{3}{4}\frac{1}{4}$; class C, $\frac{2}{4}\frac{1}{4}-\frac{3}{5}\frac{1}{5}$; class D, $\frac{2}{5}\frac{1}{5}-\frac{1}{5}\frac{1}{5}$. In class A there are 120 cases. Of these, 10 or 8.3% had severe or habitual headache and 24 or 20% had slight or occasional headache. In class B there were 122 cases. Of

these 4 or 3.2% had severe or habitual headache and 14 or 11.6% had occasional or mild headache. In class C there were 119 cases. Of these 8 or 6.7% had severe or habitual headache and 10 or 8.3% had mild or occasional headache. In class D there were 185 cases. Of these 18 or 10% had severe or habitual headache and 23 or 12% had mild or occasional headache. Comparing the classes in this group we find that the percentage of headache, considering both classes of headache together, show a proportionate decrease with the decrease of visual acuity in the amblyopic eye, except in class D where the total percentage of headache considerably increased. The percentage for each class was A, 30%; B, 15%; C, 14%, and D, 24%. I find that in class D I had included eight cases of migraine associated with severe headache. Had these been omitted the percentage in this class would have been 17 instead of 24. The total percentage of headache for all classes in this group is 20.1%.

Group IV. In this class are placed all strabismus cases of every form or degree. There are a total of 248 cases; 7 had vertical deviation, 114 were convergent cases, and 127 were divergent cases. In 6 of the convergent cases, and in 39 of the divergent cases, the squint was not constant. Of the total 114 convergent cases 12 or 10% had a history of habitual or severe headache, and 15 or 13% slight or occasional headache. Of the total 127 divergent cases 12 or 9% had habitual or severe headache and 17 or 13% slight or occasional. The convergent and the divergent show practically the same percentage of prevalence of headache.

Considering all forms of strabismus together, out of the total of 248 cases, 24 or 10% had severe or habitual headache, and 32 or 13% had occasional or mild headache, making a total for all forms of headache of 22.6% for the strabismus cases. In this group there was one case of isopia with intermittent convergent strabismus who suffered nearly daily with headache, especially after close work until he learned to cover up one eye. This gave complete relief from the headache.

Considering all four groups together for the purpose of comparing the frequency of headache we find that group I (absolute monocular) shows the lowest percentage of headache, only 2% having habitual or severe headache. Then comes

group II in which there was functional suppression of single binocular vision (cases of high anisometropia) with 4.1% of habitual or severe headache. Next in order follow groups III (amblyopia) 8%, and group IV (strabismus) 10% with habitual or severe headache.

Considering both classes of headache, the habitual or severe and the occasional or slight together, the percentages as shown in the graph are for group I, 8.3%; for group II, 11.4%; for group III, 20.1%; and for group IV, 22.6%. Thus we find that there was a proportionate smaller percentage of headache in proportion to the greater degree or completeness of monocularity.

In a review of the consecutive records of one thousand ten private cases having good binocular single vision (all cases falling under any of the groups considered in this paper being excluded, as well as all inflammatory cases) I find that the percentage of such cases having headache is 70, the habitual or severe headache being complained of in 60%, and the occasional or mild in 10%. Thus a comparison of an equal number of records of patients having constant binocular single vision with the monocular will show that severe or habitual headache occurs seven times more frequently in the former than in the latter.

There are many illustrative normally monocular patients in this series which demonstrate our premises in a converse way in that, by attempting to produce coördinate use of the eyes, severe and unconquerable asthenopic symptoms were produced. I shall not burden this paper with case histories but shall insert abbreviated records of two cases one of which illustrates the above point, and one which seemed to show that by establishing monocularity a severe cephalalgia and other asthenopic symptoms were relieved.

CASE I.—Mr. J. P. H. 55 years of age, a college graduate, teacher by profession. Has never enjoyed very good health, usual weight 125 lbs. Has had recurrent symptoms of fatigue neurosis. Ocular history: 28 years ago had an operation for a divergent strabismus. Has always been near-sighted, and has worn glasses since boyhood.

Refraction at present:

Right Eye—6.00 S. = -.75 Cy. Ax. 35° = $\frac{3}{2}\frac{1}{2}$ V.
Left Eye — 1.50 S. = -.75 Cy. Ax. 180° = $\frac{3}{2}\frac{1}{2}$ V.

Has fusion, but maintains it with difficulty; slight convergence. For the past ten years has used full correction for the left eye, and -3.25 S. = $-.75$ Cy. for the right eye. With this latter correction he has enjoyed perfect ocular comfort and has been entirely free from headache, using the left eye for distant vision and the right eye for near. About ten years ago he tried persistently under the care and direction of a competent oculist to use the full correction for each eye, but was unable to do so because of severe asthenopic symptoms which this produced.

CASE 2.—Mrs. H. R. H., 39 years of age. General health good, has not had any serious illness, but has always had a nervous temperament and describes many recurrent attacks typical of neurasthenia. Ocular history: Has suffered considerable headache over a period of many years and has never been able to use her eyes without distressing symptoms. While in college was under the care of a well-known specialist who spent several months in an attempt to give her proper correcting glasses. During this time she was unable to follow her college work, and lost several months' time. Has used glasses for 25 years. Without glasses central vision in the right eye is $\frac{2}{8}$; in the left $\frac{3}{8}$. Refraction under cycloplegic:

$$\begin{aligned} \text{Right eye} &- 1.75 \text{ S.} = \frac{3}{8} \text{ V.} \\ \text{Left eye} &+ .12 \text{ Cy. Ax. } 90^\circ = \frac{3}{8} \text{ V.} \end{aligned}$$

This is practically the same correction which she used while in college and since. She was told that it was very essential that she wear her glasses, therefore has done so. On April 18, 1919, the writer advised her to go entirely without glasses. Since laying them aside she has been very much more comfortable, has been able to use her eyes for longer periods, and has been entirely free from headache. She states that during the past two years she has not known what a headache was, and that she has never been so comfortable in all her life. With the full correction there is only a very slight muscle imbalance. In 1919 $\frac{1}{2}$ degree of exophoria. March 18, 1921, exophoria $1\frac{1}{2}$, right hyperphoria $\frac{1}{2}$.

A study of the age epoch in the relation to the frequency of headache reveals a striking similarity both in the binocular and in the monocular there being a slight peak of greater proportion between the ages of 15 and 20 years, then a sharp but small decline, the percentage then being maintained at a nearly uniform ratio between 20 and 35. Between 35 and 45 the

proportion of headache greatly increases reaching the highest peak at 45 or 46. From this age the percentage curve is sharply downward, passing below the curve of youth and adolescence at 55. From this age onward there is little fluctuation.

An explanation for the infrequency of headache in the monocular patient as compared with the patient employing single binocular vision is found in the fact that the former, because of his monocularity, must experience less nervous or brain fatigue, the normal monocular visual act being less complex, because of the elimination of the fusion sense and of coördinate muscular adjustment which are necessary in maintaining single binocular vision.

BIBLIOGRAPHY.

- SNYDACKER. *Klin. f. Augenh.*, July, 1909, p. 629.
BRAV. *American Medicine*, Dec., 1908.
WALTON. *Trans. Sec. on Ophth. A. M. A.*, 1908. *Boston Med. and Surg. Jour.*, July, 1905.
HUNTER. *N. Y. Med. Journal & News*, Jan., 1911.
RANNEY. *N. Y. Med. Journal*, June 11, 1892, p. 50.
WILDER. *J. A. M. A.*, vol. lxxi., No. 4, p. 268.
OLIVER. *System of Disease of the Eye*, Norris and Oliver, p. 449.
DONders. *Accommodation and Refraction*, p. 415.
RIDER. *Trans. Am. Ophth. Soc.*, vol. viii., p. 434.

SOME FEATURES IN THE TECHNIQUE OF TREPHINING THE CORNEA FOR THE RELIEF OF GLAUCOMA.¹

BY DR. FREDERICK TOOKE, MONTREAL.

(*With seven illustrations on Text-Plates III.-V.*)

AN approach to my subject cannot better be made than to quote Mr. Priestley Smith's remarks in introducing the discussion on the operative treatment of glaucoma at the Seventy-ninth Annual Meeting of the British Medical Association, held at Birmingham, in 1911. He asks the pertinent question: "In operating for glaucoma, ought we to adhere to the time-honored iridectomy of von Graefe, or to adopt one or other of the substitutes lately introduced? The object of every glaucoma operation is to establish filtration from the eye; if we fail in that we fail entirely."

Glaucoma cannot well be described by any one stereotyped definition. A series of pathological, or rather of ætiological, features underlying the symptoms acknowledged clinically as glaucoma have been presented of recent years. These are as many as they are varied. Burgers, Wessely, Parisotti, Kummel, Hamburger, Bjerrum, Parsons, Thompson, Martin Fisher, and Priestley Smith, himself, are some of the contributors who have attempted to solve the riddle of our science. Almost as many have presented operative procedures designed to minimize, if not to actually eliminate, the symptoms which these pathological features have induced. The outstanding contributors of recent years have been Lagrange, Herbert, and Elliot, the object of each being to establish a filtering scar.

¹ Presented at meeting of the American Ophthalmological Society at Swampscott, June, 1921.

The purpose of this contribution is not to bring into discussion the merits or faults of the operations designed by the authorities whom I have mentioned: it would be an impertinence on my part to attempt to do so. My brief for the time being is with the technique of trephining the cornea as advocated by the chief exponent of the operation, Colonel H. R. Elliot, as the operation with which I am most familiar.

It is quite probable that an enthusiastic support of this procedure will not go unchallenged by some, if not by many. To these I may as well at once reply by enquiring of them if they, in cases of chronic glaucoma, have, through their actual operative experience, anything better to offer as an operative procedure that will more consistently and with less risk diminish tension, maintain vision, and retain blind eyes whose lot was formerly an enucleation. May I further be permitted to enquire if the terror of a late infection has not been one of anticipation, rather than one of actual fact in many, many cases? I feel sure that my colleagues at the Royal Victoria Hospital, Montreal, would wish to share with me in making the following assertions. That we have practiced the operation of trephining the cornea for the relief of chronic glaucoma consistently since it was first introduced to this continent, and even before that time. Further, that in a series of nearly one hundred and fifty cases we have had less than two per cent. of late infections. That there has not been one case of initial infection recorded, and that our material has, as in any large city, included all classes of society, from pauper to patrician.

As Colonel Elliot very aptly remarked in one of his contributions on this subject: "Magna est veritas et prevalebit." The selection of my subject must not be interpreted as a presumption. The few following remarks on operative technique are the acknowledgment of an opportunity of acting as Colonel Elliot's assistant during his visit to Montreal in 1914. The enthusiastic and kindly interest which he evinced during the progress of several operations impressed us all most forcibly at the time how best the operation might be performed, and how pitfalls and possible complications might be avoided.

Since undertaking the operation on my own responsibility, or when assisting my colleagues in the department, I have always felt that one of the greatest difficulties experienced was

to keep the patient looking down. Compared with a cataract extraction, or even with an iridectomy, trephining is a slow, tedious operative procedure. There is always the desire on the part of the patient to look up, call it curiosity if you will, and even though traction be applied by fine forceps below, or pressure by a horn spatula above, at some unguarded moment when these are released the patient looks up with the result that the conjunctival flap in the process of dissection is buttonholed.

It is at the present time my practice to fix the eye downward by a double armed suture. After anaesthetizing the conjunctiva and cornea, a few drops of two per cent. anocain solution are injected into the lower lid. The needles, which should be moderately long and curved, should be inserted in a horizontal direction at the limbus corneæ below, and should include some of the episcleral fibrous tissue, very much as in the case of an advancement operation. The needles should then be passed downwards in a vertical direction, beneath the conjunctiva bulbi, as far as the lower fornix, being brought forward through the skin surface of the lid in a line with the lower margin of the orbit. Traction is brought to bear on the two ends of the suture until the globe assumes the desired position, when the suture is secured about a small piece of rubber tubing. After the introduction of an eye speculum, the operation may be proceeded with. (Figures 1 and 2.)

If there is one point more than another upon which all who support this operation are agreed, it is that the trephine must pass entirely through corneal tissue; and for this reason. The object of the trephine hole is to drain the aqueous through the cornea from the anterior chamber to the subconjunctival capillaries. It has been computed that the corneoscleral margin lies 1mm forward of the actual filtration angle (Priestley Smith). Should one operate with a 2mm , or even with a 1.5mm trephine, the actual corneal tissue not being exposed, it would be impossible to reach the anterior chamber without wounding the ciliary body, subsequently plugging the wound with pigment and lymph exudate, the result of a complicating cyclitis. Satisfactory filtration can best be secured by a procedure known as splitting the cornea, a point emphasized by Colonel Elliot in all his writings. It is, in my humble opinion, the salient feature of the operation.

How best, then, may one approach the cornea, and how best expose that portion required to accommodate the trephine without complicating any of the underlying structures. The idea is to dissect or undermine the conjunctival flap so that its mid portion will expose the actual corneo-scleral margin. This mid point of dissection is extended still further forward into the corneal tissue proper, towards the apparent limbus of the cornea, thus exposing a tiny crescentic or semilunar patch of actual corneal tissue. This area may measure between 1 and 2mm in a vertical diameter and lies directly behind the attached or hinged end of the conjunctival flap. I have seen various instruments used in the execution of this the most tedious, but, I claim, the most important step of the operation. A knife-needle, a blunt keratome, the separated blade of the scissors used in dissecting the conjunctival flap, all with the same facility of buttonholing the conjunctiva.

For some time past it has been my practice to use an instrument which I have called for want of a better name, a corneal separator. I made the original by grinding down an old Beer knife. The blade is short, it's cutting surface is 4mm wide, it is rounded at the end and beveled on both surfaces. When properly approximated to the cornea it is, consequently, almost impossible to buttonhole the cornea forward on the one hand, or to completely penetrate the substantia propria backward on the other. The instrument actually resembles a very fine mastoid chisel. A sufficient area of the substantia propria is exposed with the greatest ease, especially when the instrument is used with a lateral motion rather than vertically alone. It was made for me by Messrs. Tieman & Company, New York, to whom my thanks are due. The proper use of this very simple instrument has afforded us an opportunity of out-Elliotting Elliot at this particular and important stage of the operation. (Figures 2 and 3.)

Having exposed an area of underlying corneal tissue, allow me to digress for a moment and to define very briefly the histological features of a filtering corneal cicatrix. In an uncomplicated incision of the cornea, healing begins almost immediately. The severed ends of the corneal fibers at the mid point of the substantia propria are the first to actually unite by primary intention. A secondary downgrowth of epithelial

cells and an ingrowth of endothelium follows which successfully plug the wound. As union of the corneal fibers proceeds, these plugs are pushed forward on the one hand, and backward on the other, so that when fibrous union of the substantia propria is complete, there being no inclusion in the wound, there is little or no evidence of the epithelium or endothelium remaining.

When the cornea is trephined a definite plug of corneal tissue is excised. At a circumscribed point, at least, the severed ends of the substantia propria cannot approximate. Primary union of the corneal fibers cannot take place before an ingrowth of endothelium has occurred which completely lines the trephine hole. Consequently, the apposition of the severed ends of the substantia propria is inhibited where primary union was wont to take place. A cystoid scar thus replaces a fixed scar (Figure 4).

In a recent article by Colonel Elliot appearing in the *Transactions of the Ophthalmological Society of the United Kingdom*, a series of histological sections were shown which were intended to demonstrate part of the ligamentum pectinatum in the excised corneal plug. I must confess that I am distinctly dubious in my interpretation of the presence of the fibers of the ligament in some of the sections. For, after all, why should they be included? Granted that we expose the cornea sufficiently well forward as I have already attempted to describe. If a not too large trephine be used and it be properly approximated near the hinge of the conjunctival flap, then it should penetrate the cornea forward before Descemet's membrane breaks up to form the fibers of the ligamentum pectinatum (Figure 5).

Figure 6 shows a section through the cornea near the apparent limbus for the extraction of a senile cataract. The incision has, in fact, come out well beyond the apparent limbus of the cornea with the inclusion of a conjunctival flap. Should such a conjunctival flap have been extended still further forward according to the procedure of Colonel Elliot, and one which I am attempting to emphasize, it is difficult to suppose that the proper apposition of a moderately sized trephine could possibly include any of the fibers of the ligamentum pectinatum. That it is done by himself on occasions is admitted: it is also ac-

knowledged by Freeland Fergus that a fine spatula or probe is almost invariably inserted into the wound, breaking down the more underlying fibers of the ligamentum pectinatum before drainage is complete. In the operation as performed by us, we practically always meet with a hernia of the iris after trephining without having to insert any instrument whatsoever into the anterior chamber.

But need we regard the ligamentum pectinatum as a factor in the operation? Indirectly yes, and directly no; depending entirely upon the underlying pathological cause and the clinical form which the condition exhibits. Clinically we note two types of glaucoma, one with a shallow, the other with a deep anterior chamber. An excellent illustration of the first type which might be interpreted as one of the congestive variety; an engorged anterior ciliary process pushing the root of the iris forward thus blocking the natural egress of the aqueous through the spaces of Fontana and the canal of Schlemm (Figure 7). In such a condition the trephine operation relieves congestion, released filtration allows the iris to fall back to its former position, the normal depth of the anterior chamber is restored, the filtration angle consequently freed, and the circulation of the aqueous reestablished, not only by the cystoid cicatrix, but also by the former physiological channels.

Take, on the other hand, the question of colloid changes occurring in the aqueous, a view advanced by Martin Fisher in his work on *Œdema*. Such a condition may manifest itself in the anterior chamber, and from an altered specific gravity the structures about the filtration angle are unable to accommodate the aqueous. Such a condition is also shown in Figure 7, but existing in the posterior rather than in the anterior chamber. A feature such as this would be relieved, primarily, by the action of the cystoid cicatrix itself, independent of any mechanical or physiological release on the parts concerned in the normal channel of circulation.

One practical point in conclusion. The operation with which I am dealing has been criticized as requiring a keen near vision and a steady hand. But such essentials are necessary in every branch of ophthalmic surgery. Granted that the trephine area is small, that we can not all be myopes, and that presbyopia is the lot of man. With such problems facing us a

means had to be found to afford one the best possible vision of the field of operation without disturbing the general relationship of existing conditions. My first practice was to employ a small loupe which was worn as a monocle, one which I was in the habit of carrying about with me for the detection of foreign bodies embedded in the conjunctiva or cornea. This served my purpose admirably. It had the distinct disadvantage, however, of not being worn with equal facility by every operator. Doctor Byers was one to appreciate this difficulty very early and adopted the practice of using a Zeiss binocular. But this proved to be clumsy and had the distinct disadvantage of closing off all but the actual field of operation. We have compromised by using the Beebe Hardy binoculars which are of inestimable assistance at every stage of the operation, but more especially in exposing the corneal fibers before the trephine is applied.

PRESBYOPIA.¹

BY PROFESSOR E. FUCHS, VIENNA.

I BEG to thank you most sincerely for the great honor you have done me by your invitation to read a paper before you.

I beg your indulgence for not having chosen a more interesting topic than presbyopia for my lecture, interesting maybe only by the fact that all of us have to submit to it sooner or later. Presbyopia is scarcely mentioned in modern ophthalmologic literature so that one might infer that there is a general consensus of opinions about it, which is by no means the case.

Stellwag was the first to distinguish presbyopia from hypermetropia, recognizing that there is a difference between the two as to the situation of the far point and therefore he denominated hypermetropia as hyperpresbyopia. We owe to Donders the sharp distinction between refraction and accommodation and on this ground between presbyopia as a diminution of accommodation and hypermetropia as an error of refraction, whose characteristic is the position of the far point behind the eye, independently of age and accommodation.

Already before Donders had laid down his principles in what we may call the bible of the refractionist, it was known that there was a practical difference between a presbyope and a hypermetrope in that the first could not see close objects distinctly, but also did not suffer from asthenopia, whereas the latter, as long as he was young, could see at a near distance but was prevented from prolonged work by asthenopia. Donders accounted for this by the fact that the asthenopia of the hypermetrope is due to the overstrain of the ciliary muscle,

¹ Read at meeting of the Section on Ophthalmology, New York Academy of Medicine, October 17, 1921.

the indistinct vision of the presbyope to the diminution of the elasticity of the lens, the ciliary muscle in this case contracting only as far as it is efficient, *i.e.*, is followed by an increase of refractivity of the eye. Now the opinions diverge as to the amount of ciliary contraction in presbyopia, a direct measurement of this being impossible. We can measure it only as far as it reveals itself by the increase of refractivity, therefore only in young persons in whom this increase corresponds practically to the degree of ciliary contraction. When in old age the lens does not respond more fully to the contraction of the ciliary muscle, we may in this respect suggest various conceptions, without being able to support them by definite proofs.

So Monoyer and Landolt assert, that to each fraction of the actual range of accommodation corresponds an equal fraction of the entire contraction of the ciliary muscle, whatever may be the age of the person. According to this theory the adjustment for the near point requires the maximum of ciliary contraction in an old man just as well as in a child. Hence these authors apply Donders's statements regarding the relative range of accommodation also to the presbyope. According to Donders prolonged work at a given distance is possible only if, when focusing the eye for this distance, the positive part of the range of accommodation is sufficiently great. Landolt and Monoyer admit that this is the case, if the positive part is at least one-third of the total range of accommodation, so that, for instance, a man of sixty with a range of accommodation of 1 D. can for prolonged use employ only two-thirds of it, *i.e.*, 0.67 D. and has to keep a reserve of 0.33 D. But, in fact, the laws of relative accommodation as they hold good for young persons, do not apply to old ones as shown by the diagrams given by Donders himself, according to which in old people the increase of convergence is no longer followed by an adequate approximation of the near point. It is also a common experience that a presbyope may work at his near point without any inconvenience.

Landolt's conception could be understood, if, according to Tscherning's theory, accommodation were produced by active stretching of the fibers of Zinn in consequence of the contraction of the ciliary muscle, but not, as it is, by relaxation of those fibers. This allows the lens to become more convex as far as

its elasticity permits. That beyond this point which corresponds to the near point, a further contraction of the ciliary muscle is possible, is proved by the fact, first stated by Hess, that in an old person a strong effort of accommodation is not followed by an approximation of the near point, but by a drooping of the lens due to the fact that the relaxation of the fibers of Zinn exceeds the possible reduction in the circumference of the rigid lens. This is reached already with a very slight relaxation of the zonula, effected by only a small fraction of the entire power of the ciliary muscle. If the latter contracts beyond this fraction, the contraction would not manifest itself by a further increase of refractivity. Therefore according to this, accommodation may be viewed in two ways. We may see in it either the contraction of the ciliary muscle, or on the other hand, the effect of this contraction, *i.e.*, the change of refractivity. Only in this latter sense is accommodation accessible to measurement and may be called the manifest accommodation and its near point, the physical near point, it corresponds to what is usually called accommodation. Contrariwise, the accommodation considered as contraction of the ciliary muscle, may be termed physiological accommodation and the maximum of contraction the physiological near point. The physical near point coincides with the physiological in childhood and recedes from it gradually with the advance of age, so that more and more of the physiological accommodation becomes latent.

In the diagram representing the range of accommodation at different ages given by Donders, and later in a more accurate way by Duane, you notice, below, the nearly horizontal line indicating the position of the far point and, above, the line corresponding to the physical near point, approaching more and more the far point line so as to join it at the age of seventy. Now if you draw in this diagram a line corresponding to the physiological near point, it ought to begin at the starting point of the physical near point line and run from there pretty nearly horizontally, as the strength of the ciliary muscle remains presumably unchanged for many years and declines only in old age, when histological preparations show a slight reduction of the muscular bundles. The area between the two parallel lines, representing the far point and the physiological near

point is divided by the physical near point line into a lower half, corresponding to the manifest part and an upper half, corresponding to the latent part of the physiological range of accommodation, the latent part enlarging in the same measure as the manifest part diminishes. If this conception is right, as I believe, the manifest accommodation requires, excepting in childhood, only a part, constantly decreasing with age, of the total power of contraction of the ciliary muscle. This is evidenced by the experiments of Treutler. He applied a drop of a 2% solution of euphthalmine to the eye, which effects only a partial paralysis of the ciliary muscle. In the eyes of a youth of 11 years, it reduces the range of accommodation by 4 D., whereas it does not produce a retrocession of the near point in the eyes of a man of 38, because the latter requires for the adjustment to the near point only a part of the whole power of ciliary contraction, so that a slight paralysis of the ciliary muscle concerns only the latent part of the physiological range of accommodation.

If we concede, that with advancing age the manifest accommodation requires but a fraction of the possible ciliary contraction, the question arises, as to the amount of this fraction, in which respect two possibilities suggest themselves. The first is, that the amount of ciliary contraction keeps pace with the convergence. In young persons, when the increase of refractivity corresponds still more or less to the ciliary contraction, it is easy to state that the curve of accommodation and of convergence run a parallel curve. The relation between the two is not absolutely strict, but can be varied only within certain limits as Donders has proved by showing the existence of a relative range of accommodation, and of convergence. This limitation proves the intimate connection between accommodation and convergence which is probably like the connection between convergence and pupillary contraction, due to a corresponding connection between the nervous centers presiding over these functions. Hence we see, that if a change of refraction shifts the region of accommodation either from or to the eye, the stimulus to convergence does not easily comply with the altered condition. The greater amount of accommodation to which a hypermetropic eye is forced, is nearly always followed by an excess of convergence, esophoria or

convergent squint, and the same holds good as to the relation between myopia and exophoria or divergent squint. If the original connection between accommodation and convergence is nearly compulsory in youth, it is not likely that it should be given up in old age, when presbyopia is coming on. For this reason it seems probable that also in the presbyopic eye the physiological accommodation, *i.e.*, the contraction of the ciliary muscle, should correspond to the point of convergence and not to the point for which the eye is focused. According to this conception a man with a near point at 33cm, when working at this distance would converge for 33cm with an accommodation of 3 D., just as he did, when he was young. Some years later, his near point having receded to 100cm he would, when working at 33cm with the aid of a convex lens of 2 D., still make the same effort of his ciliary muscle as before, *i.e.*, 3 D. corresponding to the convergence, but of this physiological accommodation only 1 D. would become manifest, and 2 D. would remain latent. After the complete loss of physical accommodation, he would, when working with a 3 D. glass at 33cm, contract his ciliary muscle just as much as before but his physiological accommodation of 3 D. would now remain entirely latent. So the ciliary contraction with work done at 33cm would be the same, the whole life through and the change due to age would be only that after the onset of presbyopia more and more of this contraction becomes latent because inefficient. The entire power of ciliary contraction amounting probably to 15–20 D. and in very old age maybe not less than 10 D., a 3 D. physiological accommodation would always represent but a small part of the whole,—not enough to cause exhaustion. This conception permits us to consider Donders's law of the relative range of accommodation and its meaning as to prolonged work valid for all ages, if we determine the range of accommodation not according to the refractivity of the eye or the physical accommodation but according to the ciliary contraction or physiological accommodation. The curve of this may be assumed to run parallel with the curve of convergence throughout life, although there is no possibility of proving it.

The other assumption conceived by Donders, is that the presbyope contracts his ciliary muscle only as far as it is

efficient in increasing the refractivity, in other words, that the physiological accommodation always equals the physical. According to this an old man with an accommodation of 1 D., equal to a near point at 100cm and reading with a glass of +2 D. at 33cm would contract his ciliary muscle only corresponding to an accommodation of 1 D. With 70 years, after complete loss of accommodation the man would read with a +3 D. glass at 33cm without any contraction of his ciliary muscle. A man with a stiff elbow, who cannot bend his arm beyond a certain angle, would soon learn to contract the flexor muscles only up to that point. Likewise one might assume that the presbyope learns by experience to contract his ciliary muscle only as far as it is efficient, but contrariwise to the man with the stiff elbow, he would have to renew his experience constantly according to the progression of the rigidity of his lens. This theory would seem to be the commonsense one. But it supposes, that with the advance of age a constant change of the correlation between accommodation and convergence takes place. Now it has already been pointed out, that such a change, already difficult in youth, is still less likely in old age. Hence I believe to be the most probable assumption, that through the whole life the contraction of the ciliary muscle or the physiological accommodation keeps pace with the convergence, so that the presbyope does not require a special and constantly renewed adaptation to new conditions.

The above theory does not exclude the likelihood that in exceptional cases the desire to see near objects more distinctly, may induce a presbyope, especially in the beginning of presbyopia, to make an exaggerated effort of his ciliary muscle, not only inefficient, but even prejudicious to distinct vision. The troubles arising from such an excess of ciliary contraction are:

(1) Asthenopia. As a rule, the presbyopes do not suffer from asthenopia but there are exceptions to this rule. I remember patients, who in the onset of presbyopia did not complain of defective sight, but of headache and pain in the eyes after near work. As this asthenopia is relieved by proper convex glasses, it must be attributed to an excessive strain of the ciliary muscle as in hypermetropia. I imagine that such patients, not seeing distinctly any longer at their usual working distance, attempt to do so by an increase of ciliary con-

traction as they were previously accustomed to do, when, desirous of seeing small objects better, they brought them closer to the eye. But then they were also converging more, while now they make an effort to accommodate by an amount greater than corresponds to the convergence. It is probably this disproportion, which causes the discomfort, even if the absolute amount of the excessive ciliary contraction be small and not capable itself, of producing asthenopia. Young hypermetropes may suffer from asthenopia even with a total hypermetropia of not more than 2 D., too small an amount compared with their entire range of accommodation to effect asthenopia, so that I rather believe the latter is due to the fact, that these hypermetropes have not succeeded in adapting themselves sufficiently to the altered correlation between accommodation and convergence. If they do this, for instance by squinting, they are less subject to asthenopia than not squinting hypermetropes with the same degree of hypermetropia.

(2) Micropsia. There are rare instances, in which, in the onset of presbyopia, people do not complain of indistinct vision, but of seeing the print smaller and sometimes also more remote. Hess explains this by saying that the presbyope holds the book farther away and therefore gets smaller retinal images of the letters. But under normal conditions removing an object does not make it appear smaller, because, when interpreting our retinal images, we take the distance of the object unconsciously into account. It is only, if we are mistaken as to the distance of the object, that our estimation as to their size becomes erroneous. This occurs in cases of paresis of the ciliary muscle as well as in some cases of beginning presbyopia. In both cases the man strains his ciliary muscle in an amount greater than corresponds to the distance of the object and thinks it therefore nearer than it is, and as the retinal images did not enlarge correspondingly as he expected, he believes the objects to have become smaller.

In the presbyopic cases as a rule, the micropsia sets in only after having read for a while. Probably at first the excess of ciliary contraction is only slight, and as it proves to be inefficient, is gradually increased more and more.

(3) Protracted change of optical adjustment. After having looked for a while at near objects, for instance, after reading,

it may occur, that when looking at distant objects, a person requires some time, to see them distinctly. There are also very rare cases in which the contrary takes place, namely that after having looked at distant objects, the eyes adjust themselves to near objects only after a while. The delay in the adjustment from distant to near vision is sometimes also observed before the beginning of presbyopia, chiefly in cases of hypermetropia. I beg leave to report a few cases, in which the delay was unusually great. A man of 35, emmetropic and with vision $- \frac{6}{6}$, required after prolonged reading a glass of -1.5 D., to see distinctly at a distance and have $\frac{6}{6}$. A man of 57 with a myopia of 1 D. is still doing his work without spectacles and without discomfort, but returning home from his office, it takes a considerable time for him to see distinctly in the street with his glasses of -1 D. A man of 50, emmetropic, uses $+1.5$ D. for his work. After having read for at least one hour, he sees indistinctly at a distance and it requires sometimes another hour, until his distant vision becomes normal.

The delay of adjustment occurring chiefly in the onset of presbyopia and besides in hypermetropia, it would not do, to consider it as a symptom of some muscular or nervous disease, but rather as the consequence of the disturbed relation between convergence and accommodation. This needs no further explanation as to hypermetropic eyes. With respect to the presbyopic cases, we may also attribute it to the same trouble, the presbyope desirous of seeing near objects better, contracting his ciliary muscle more than corresponds to the distance of work, *i.e.*, to the convergence. It may then occur, that when now looking at distant objects, so that the convergence goes down to zero, the accommodation is relaxed only by the same amount, so that still some accommodation remains behind.

DIFFERENTIAL PUPILLOSCOPY.

BY DR. OTTO BARKAN, SAN FRANCISCO.

(*With one illustration on Text-Plate VI. and two in the text.*)

DUE to the gross methods employed and to their subjective nature the examination of the pupillary reaction has up to the present been an eminently unsatisfactory one. This fact is reflected in the terminology used, the reaction being designated "normal," "present," "weak," "good," or "sluggish" according to the judgment of the individual observer. There has been no objective means of determining or measuring quantitatively the reaction or any criterion of what really constitutes a normal reaction. The so-called sluggish reaction has remained a source of trouble and annoyance to neurologist and ophthalmologist alike.

In the differential pupilloscope of C. v. Hess all sources of error have been eliminated and a very exact quantitative method inaugurated.

The original description of the method and results obtained therewith may be found in the publications of Hess and Groethuysen. In the following article the attempt has been made to present the abridged subject matter in as concise and amenable a form as possible. In doing this the writer has interpolated his own conclusions, based on the observation of over three hundred cases.

INSTRUMENT AND METHOD OF EXAMINATION.

The patient's eye is observed through a telescope of eight magnifications. Through tube A light is cast upon the eye. In front of this tube is a frame B consisting of an upper and a lower compartment, the upper, b, containing a grey glass of

known permeability to light. The lower, c, contains two grey prisms, gradated and calibrated, which can be made to slide upon one another by means of a micrometer screw (d). The prisms are most permeable to light at their apices and least at their bases so that the permeability of the system of prisms varies according as to whether the apices, bases, or intervening portions are superimposed. We can therefore by manipulating the micrometer screw obtain at will any desired intensity of light or conversely for any given position of the prism read off on a scale their position and therewith the amount of light passing through. For example a position of the prisms can be found at which their permeability will equal that of the constant grey glass. When this is the case the same amount of light will strike the eye irrespective of which compartment of the frame it is traversing, and by swinging these up and down the eye will be successively illuminated with lights of equal intensity. Consequently the pupil remains immobile since successive illumination with lights of equal intensity is the same as illumination with one constant light.

In practice and in order to obtain objective results we first proceed with differences of light sufficient to excite a marked reaction and then gradually diminish the light differences, by varying the positions of the prisms, until the least difference of successive light intensities is found which just suffices to elicit a pupillary reaction. In this manner we measure the *motor discriminative acuity* (M. D. A.) of the case in question. Physiologically this is the case when the difference of light intensities is as 95 to 100, or in other words, the *smallest differences of light intensities between which the normal pupil can discriminate is as 95 to 100*. This value is constant, is irrespective of the age of the individual, and is independent of the state of adaptation.

In practice the M. D. A. is not numerically designated by the actual differences of light but by a quotient (Q), which is obtained from it by a simple process of arithmetic. Physiologically $Q = 0.9$. The lowest limit of the physiological is 0.84. Diminution of Q to 0.84 is definitely pathological. *A pupillary lesion of such small degree is not detectible by any other method.* In fact I have seen cases in which Q was reduced to 0.6 and yet excellent clinical observers, using the

usual methods, were unable to detect any pathological change in the reaction. In this connection it is interesting to note that the consensual reaction is in normal cases exactly equal to the direct.

By proceeding similarly to the above we can further determine the *visual discriminative acuity* (V. D. A.) of the case. This is done by the subject stating which of the successive lights is the brighter. Under normal conditions the V. D. A. is found to exactly equal the M. D. A. That is *the smallest difference of light intensity between which the pupil can discriminate can also still be discriminated visually by the patient and vice versa.*

GENERAL FACTS REGARDING THE RELATIONS BETWEEN THE M. D. A. AND V. D. A. IN DISEASES OF THE VISUAL ORGAN.

A short review of the anatomical and physiological facts underlying the pupillary reaction may at this point prove helpful. It is well to bear in mind that the retina in its entire extent acts as receptor for impressions of light and therewith for the visual discriminative acuity. The pupillomotoric area of the retina, however, as shown by Hess, is in the main restricted to the fovea and a small circumfoveal area. Thus the pupillary response obtained by illuminating a peripheral part of the retina is due to diffusion of light to the foveal area. Consequently the M. D. A. is a function mainly of the foveal area and macular bundle of the optic nerve whereas the V. D. A. is a function of the entire retina and so also of the optic nerve in its entire diameter.

The pupillary reflex arc may be schematically represented as in Figure 2. Although the anatomy of this reflex is not yet definitely known, it seems certain that somewhere in the region of the corpora quadrigemina the pupillary fibers branch off from the optic tract, as at 4, to proceed to the third nerve nucleus. These fibers constitute a link between the afferent and efferent limbs of the arc and may in this sense be designated as the "intercalated," connecting or junctional portion of the arc. Lesion of this intercalated path is the anatomical substrate of the Argyll-Robertson pupil. Hess accordingly calls the Argyll-Robertson pupil a "schalt lesion" or "lesion of the intercalated path." The intimate nature of the tabetic lesion

of the "schaltung" does not concern us here. Bumke (3) discusses this point in full. Let it suffice that the schematic

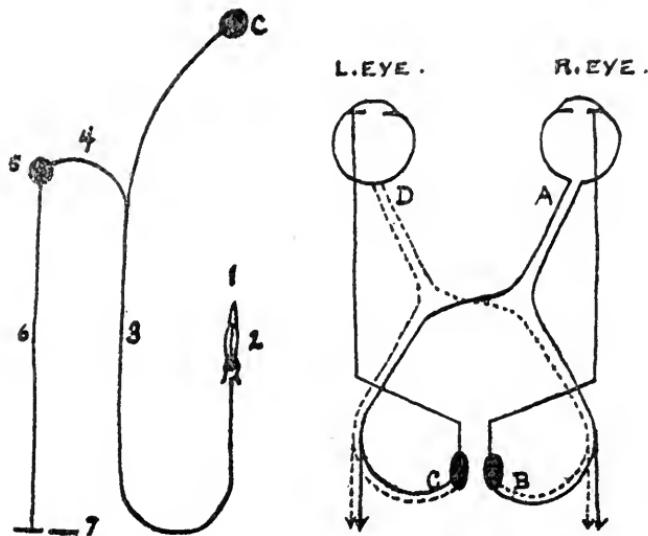


FIG. 2.

FIG. 3.

representation of the pupillary reflex arc in Figure 2 satisfies all results obtained with the pupilloscope.

- 1. Dioptric apparatus.
 - 2. Optic receptor (retina).
 - 3. Fibers (between the receptor and that point of the optic tract where the pupillary fibers branch off).
 - 4. Intercalated portion (between the above mentioned point of the optic tract and the third nerve nucleus).
 - 5. Nucleus.
 - 6. Third nerve.
 - 7. Ciliary muscle.
- } Sensory portion
of
reflex arc.
- } Motor portion
of
reflex arc.

Figure 2 shows in a general way how the motor and visual D. A. must be affected according to the situation of a lesion in the reflex arc.

1. In dioptric lesions (vitreous opacities, cataract, refractive errors), both M. and V. D. A. are normal.
2. Lesion of the sensory portion diminishes both acuities.

3. In lesion of the intercalated portion (Argyll-Robertson pupil), the M. D. A. is diminished while the V. D. A. remains intact.

4. In lesion of the motor portion the same obtains as in 3, and in addition the convergence reaction is impaired.

5. In lesions cortical to the point where the pupillary fibers branch off the M. D. A. is normal and the V. D. A. is impaired.

Without as yet calling upon the consensual reaction for diagnostic aid we may therefore provisionally classify lesions of different parts of the reflex arc as follows:

<i>Lesion</i>	<i>M. D. A.</i>	<i>V. D. A.</i>	<i>Convergence reaction</i>
1. In sensory path	diminished	diminished	normal
2. In intercalated path	diminished	normal	normal
3. In motor path	diminished	normal	diminished
4. Cortical	normal	diminished	normal

A very valuable diagnostic aid for differentiating between a lesion of the sensory portion (receptor or fiber lesion), and a lesion in other parts of the reflex arc is obtained by comparing the direct with the consensual reaction. This is rendered possible by the fact that the pupilloscope gives exact numerical values for the consensual as well as for the direct reaction. It is only by comparing the exact values of both that complicated affections of the reflex arc can be detected and localized. The following examples in conjunction with Figure 3 illustrate the importance of the consensual M. D. A. for localizing purposes. For the sake of clarity all nonessentials have been omitted from the diagram.

I. Suppose we find the M. D. A. of the R. Eye to be normal (0.9), and of the L. Eye to be 0.6. Then this diminution of the M. D. A. of the L. Eye may be the result of a lesion at D, (receptor or a fiber lesion), or of an intercalated lesion at C. In the former case the stimulus is partially blocked by an obstruction at D, the reduced stimulus being thereupon transmitted by the intact intercalated path (C), to the nucleus which in turn causes a pupillary contraction corresponding in degree to the intensity of the stimulus received. In the latter case, however (lesion of the intercalated path at C), the stimulus proceeds unimpeded until it meets with the obstruction at

C and its intensity is there reduced according to the amount of obstruction. In both cases the end result will be the same, namely, diminution of the M. D. A. of the L. Eye. By now measuring the consensual M. D. A. we are able to determine whether the lesion be at D or at C. If upon illuminating the R. Eye, for which $Q = 0.9$, we obtain the same value (0.9) for the consensual reaction of the L. Eye we know that C must be intact and the lesion must be at D. If on the other hand we find the consensual reaction of the L. Eye equals 0.6 (which is the same value as of the direct reaction of the L. Eye), then, since the path traversed by the stimulus to reach the nucleus includes besides the intact receptor and optic nerve of the R. Eye also the intercalated path of the L. side, C, the obstruction or lesion must be at C. The consensual reaction of the R. Eye on the other hand, being dependent upon a stimulus originating in the L. Eye and traversing B and D on its way to the nucleus of the R. side, will obviously not be affected by a lesion at C. If the lesion be at D, however, it will be diminished in the same degree as was the direct reaction of the L. pupil, ($Q = 0.6$).

Generalizing we may say that in the case of a lesion of the intercalated path (Argyll-Robertson pupil), the direct and consensual M. D. A. of the same eye are equal, whereas in the case of a receptor or fiber lesion the consensual M. D. A. of one eye is equal to the direct M. D. A. of the other eye.

For example let us suppose the M. D. A. of the R. Eye to be 0.4 and of the L. Eye 0.6. If this diminution from the normal of 0.9 is due to a lesion in the sensory portion (e.g., optic nerve), the values for the consensual reaction will be as follows:

	R. E.	L. E.
Direct M. D. A.	0.4	0.6
Consensual M. D. A.	0.6	0.4

If, however, the above diminution of the M. D. A. is due to lesion of the intercalated path (Argyll-Robertson pupil), the values of the consensual reaction will be as follows:

	R. E.	L. E.
Direct M. D. A.	0.4	0.6
Consensual M. D. A.	0.4	0.6

The following example illustrates the results in a more complicated case in which the diminution of the pupillary reaction was due to two lesions, one situated in the sensory portion of the L. side and the other in the intercalated path of the R. side:

	R. E.	L. E.
Direct M. D. A.	0.4	0.4
Consens. M. D. A.	0.16	0.9 (normal).

The following are the results in a case in which two causal lesions were diagnosed and localized on the same side:

	R. E.	L. E.
Direct M. D. A.	0.2	0.9 (normal).
Consens. M. D. A.	0.4	0.5

Analysis of the above, which I must forego because of limited space, localizes one lesion in the sensory and the other in the intercalated path, both of the right side. In this particular case the diagnosis was optic atrophy with superimposed Argyll-Robertson pupil, both of the R. side.

More than three coincident lesions of the reflex arc can also be differentiated and localized.

GENERALIZATION OF RESULTS OBTAINED IN LESIONS OF THE REFLEX ARC ACCORDING TO THEIR SITUATION.

DIOPTRIC ERRORS.

In errors of refraction, opacities of the vitreous or lens, no matter how great the diminution of vision, the M. D. A. is the same as in the normal eye.

RECEPTOR LESIONS.

In accordance with what was stated above in regard to the foveal localization of the pupillomotoric area a centrally situated (macular) receptor lesion affects the M. D. A. more than the V. D. A. Moreover a central lesion will first of all affect visual acuity without necessarily affecting the M. D. A. provided that sufficient foveal elements remain to transmit the pupillomotoric impulse. If on the other hand we find the

M. D. A. affected by a receptor lesion we may conclude that vision must be diminished as well. *This positive evidence when found in the case of cataract contra-indicates operation.*

For a detailed account of the various affections of the fundus and their influence on the two discriminative acuities I refer to Groethuysen (2).

FIBER LESION.

I. OPTIC ATROPHY:

At the very beginning when vision is still 1.0 and the visual field shows no definite change the pupil is wider than one would expect and its contractions are smaller. The following case is characteristic for one-sided optic atrophy.

W. H., age 34. R. disk is a trace paler than left. Vision R. 1.0, and J_r (not as clear as L.), L. 1.0 and J_r. R. visual field shows very slight concentric contraction. No scotoma.

Pupilloscope:	M. D. A.	V. D. A.
R. E.	0.9	0.9
L. E.	0.9	0.9

On direct illumination the R. pupil is wider than the left and its contractions are smaller than on the L. side.

Diminution of the M. D. A. does not, however, occur until vision has been reduced to 0.3 and the visual field impaired. *Diminution of the M. and V. D. A. runs parallel through all stages of optic atrophy* from the beginning until amaurosis and immobility of the pupil. This fact is of great importance for the differential diagnosis and analysis of a diminution of the M. D. A. caused by optic atrophy with coincident lesion of the intercalated portion. That is to say *we can in the presence of any degree of optic atrophy diagnose an Argyll-Robertson pupil* and even express numerically the respective part played by each process in causing the diminution of the pupil reaction. The combination of optic atrophy and Argyll-Robertson pupil is frequent.

2. RETROBULBAR NEURITIS AND PAPILLITIS.

In acute retrobulbar neuritis both acuities are diminished to an equal extent. In the chronic form if the macular bundle is

selectively affected the M. D. A. is diminished more than the V. D. A. It is of interest to note that *papillitis, which affects the M. D. A., gives a bad prognosis.*

LESION OF THE INTERCALATED PORTION.

(Argyll-Robertson pupil or reflex iridoplegia)

In this case visual acuity and V. D. A. are normal whereas M. D. A. is diminished in proportion to the degree of the lesion. Convergence reaction is intact. In addition to the above simple relations one finds that the contractions of the sphincter are not equal in all parts of the pupil. In fact different values of M. D. A. are often obtained for different parts of the sphincter until, as the disease progresses the M. D. A. of the entire sphincter is impaired. Such pupils show deformity and this finding alone is evidence in favor of an Argyll-Robertson pupil.

As illustrations the following cases may be cited:

CASE 1.—K. K., age 47, suspected metalues. V = 1.0 and J₁. Fundus: n.

Pupilloscope:	R. E.	L. E.
Direct M. D. A.	0.91	0.86
Cons. M. D. A.	0.91	0.86
Visual D. A.	0.91	0.91

Convergence reaction present. Pupils; R., round; L., slightly deformed nasally; the contractions here are smaller than in the other parts.

This case illustrates the typical beginning of an Argyll-Robertson pupil.

CASE 2.—M. B., age 53. In clinical treatment for epileptiform fits. V = 1.0 and J₁. Fundus: n.

Pupilloscope:	R. E.	L. E.
Direct M. D. A.	0.24	0.56
Cons. M. D. A.	0.24	0.56
Visual D. A.	0.91	0.91

Convergence reaction present. Both pupils irregularly deformed, the sphincter contractions being slightly different in different parts of pupil.

In these cases the speed of the pupillary contraction may be normal and is by no means always "sluggish." For this reason Hess has dropped the term "sluggish" in cases of reflex iridoplegia. The essential nature of the change constituting what is termed the Argyll-Robertson pupil (reflex iridoplegia), is a diminution of the M. D. A. *An Argyll-Robertson pupil can be detected at a much earlier stage than has hitherto been the case. For the early diagnosis of tabes in particular Hess's method of determining the M. D. A. has proved of the greatest importance.*

LESION OF THE MOTOR PORTION.

Here the relations of the M. and V. D. A. are the same as in the above case but in addition the convergence reaction is impaired. In practice this lesion is difficult to differentiate in its very beginning from an early Argyll-Robertson because we possess no exact method of measuring the convergence reaction analogous to the above method of measuring the light reaction. As, however, the ætiology is in most cases the same for both of these lesions (for absolute iridoplegia lues or metalues; for the Argyll-Robertson pupil always metalues), this want is in such cases of no great import.

CONCLUSIONS.

The differential pupilloscope is of particular value for the early diagnosis of tabes. An Argyll-Robertson pupil can be definitely diagnosed at a time when to our present method the pupil reaction appears quite normal. In view of the fact that pupillary changes often appear many years in advance of all other metaluetic symptoms the importance of an early diagnosis is evident from a therapeutic point of view. Moreover the diagnosis of such a pupillary lesion can be made irrespective of coincident optic atrophy, opacities of the media or even of synechiae so long as in the latter case a portion of the pupil is not mechanically impeded in its freedom of movement.

As there exists a physiological standard for the reactivity of the pupil which is independent of the age of the individual and as the reactivity of the pupil can be measured with mathematical accuracy and be numerically expressed we are able in

any given case such as anisocoria, deformed pupils, etc., to determine with certitude whether the anomaly in question is pathological or not. If the former is the case the lesion can in most cases be localized as well.

The method is a very useful adjunct for the detection of simulation or aggravation. In some of these cases it proves to be a decisive diagnostic factor.

It is also of aid in the early diagnosis of optic atrophy. Moreover, it affords an objective method of measuring the color sense. Hess has shown that the reactivity of the pupil shows characteristic values for different colors.

Since the reactivity of the pupil is not affected by opacities of the media the method retains its full diagnostic value in the presence of cataract, opacities of the vitreous, etc. It may in some cases of cataract in which, according to our present methods conditions seem normal, contra indicate operation or indicate the giving of a very guarded operative prognosis.

The differential pupilloscope measures the motor and visual discriminative acuities. In order to avoid these newly coined terms and for the sake of facility of comprehension I have in the above conclusions deemed it advisable to use the expression "reactivity of the pupil" in their stead and wish, in order to avoid possible misinterpretation to call attention to this fact.

LITERATURE

1. C. v. HESS. "Zur Physiologie und Pathologie des Pupillenspieles." *Arch. f. Augenheilk.*, 60 Bd., 1908.
- ✓ C. v. HESS. "Das Differential Pupillskop." *Arch. f. Augenheilk.*, 80 Bd., 1916.
- C. v. HESS. "Messende Untersuchungen aur vergleichenden physiologie des Pupillenspieles." *Archiv für Ophth.*, 90 Bd.
2. GROETHUYSEN. "Ueber die Beziehungen zwischen motorischer und optischer Unterschiedsempfindlichkeit bei normalen und krankhaften Zuständen des Schoggans." *Arch. f. Augenheilk.*, 87 Bd., 3 und 4 Heft.
3. BUMKE. *Die Pupillenstörungen bei Geistes und Nervenkrankheiten*, 1914.

EARLY CATARACT (SENILE), PTOSIS, AND AFTER-CATARACT.

BY COLONEL HENRY SMITH, I.M.S. (RETIRED) LONDON, ENG.

EARLY CATARACT: Our knowledge of the causation of early cataract is hardly even in the stage of theory. Not one of the few theories advanced will stand the test of facts. How could it be otherwise? We know nothing of the nutrition of the lens or of the elimination of its waste in health.

Pathological anatomy up to the present time does not bear on this issue.

Its extreme prevalence in certain localities—the Plains of North West India—does not help us much. Its relative absence in other parts of India helps us equally little. Where it does prevail, the diet is chiefly wheat, maize, and peas with fats. Where it does not prevail to the same extent as in the Himalayas, Bengal, Burmah, etc., the chief articles of diet are rice, maize, and peas. You would thus be disposed to say that wheat, as the predominating article of food, had something to do with it. We must be cautious about a theory such as this. Except in Burmah the people belong to the Aryan race chiefly so that there is no racial element in the matter. It is clearly not a starvation disease in the ordinary sense of the term, as, of the areas most affected, the peasantry are physically the finest in the Indian Empire, and there is no question of malnutrition or starvation amongst them, viz., in the Panjab.

Undue exposure to glare (actinic rays) has been advanced as a causation but this influence again is as great in the non-cataractic areas as in the cataractic areas.

The earliest symptom of senile cataract is *failing distant vision*. I think I was the first to advance this observation.

The patient's near vision with spectacles is good for ordinary purposes when his distant vision is reduced to less than one half. This is a very noticeable fact to anyone in the Panjab who examines railway employees once a year. These men require vision of $\frac{1}{2}$; normal vision is much better than this. When distant vision falls to $\frac{1}{2} - \frac{1}{10}$, or even $\frac{1}{2}$ you may observe nothing in the lens further than that it does not transmit light as well as a normal lens. You observe this fact by having a normal case on one stool and one of these cases on another—and on examining the eye of both including the retina with an ophthalmoscope with the same light. You observe how clear every structure is in the normal cases and that at the same time you make out with equal ease the structure of the retina in the early cataract case. The retina appears in the one as if you were examining with a good light and in the other with a poor light, though it is the same light in both cases. In these early cases you occasionally see the appearance of black sand, like particles in the periphery of the lens. In other cases you may see a few opaque striæ making their way from the periphery towards the center. The center in either case usually remaining clear. These appearances are unusual before vision has been reduced below $\frac{1}{10}$.

In people below thirty the appearance of small oil droplets take the place of the above-mentioned appearances.

It is evident to anyone that the old description of cataract as mature and immature are only referring to the later stages of the disease. It is evident that there must be an earlier stage and that cataract does not develop all at once. As regards the treatment of the early stage of cataract: Many years ago I had an Anglo-Indian patient, about 50 years of age. She had a very slight nebula on the center of the cornea of each eye due to a recent ophthalmia. I saw with the ophthalmoscope that she was suffering from the early stage of cataract in addition. She told me that her vision had become useless for anything distant or anything fine. I gave her a subconjunctival injection of cyanide of mercury in each eye which I believed would clear up her corneal nebulae. I told her to write and let me know a few weeks later how the vision fared both for near and distant. She told me her vision had recovered to be as good as ever it was, both near and distant. It struck me on thinking

over the case that this was impossible unless on the understanding that the hyperæmia (which I had induced) had also influenced the nutrition of the lens.

In the railway people and others who came before me I had plenty of early cataracts and proceeded to treat them on the same lines and was agreeably surprised to find that the same treatment was equally successful. I tried them at different stages and found that up to $\frac{1}{10}$ we might expect to be successful in almost every case. Even $\frac{1}{2}$ will recover to $\frac{1}{2}$. But while the result in $\frac{1}{10}$ and less lasts for years $\frac{1}{2}$ or more has a tendency to recur. I do not wish you for a moment to think that dead tissue such as sandlike opacities or minute opaque slitæ, when present, disappear. I have had many such cases under observation for years and am satisfied that such treatment is eminently satisfactory both for the surgeon and for the patient. As regards the future of this question, the general practitioner has to be educated to recognise that *failing distant vision in people over forty* is the first sign of cataract and that it is his duty then to send the patient to an ophthalmologist for investigation. If this were done in every case it seems to me that operations for senile cataract will in the future become less frequently necessary and that it will be found that the early stage of cataract will be found to be more frequent over 50 years of age than is probably supposed.

Since my first paper on this subject I am aware that eye baths containing iodide of potassium and other agents have been tried over long periods with success. I have tried iodide of potassium subconjunctivally and find that from 15 to 18 grs. to the ounce give an efficient hyperæmia, the results of which are about the same as those obtained from cyanide of mercury. It seems to me that no matter what the agent used is the result does not depend on the agent but on the hyperæmia.

From my observation of malingeringers it seems to me that drops of a nicotine solution would be as efficient as any for inducing hyperæmia.

Since my first paper on this subject I am aware that a number of men have tried this treatment and have not been so successful. I would here issue a warning note, viz., that care has to be taken in the diagnosis as failing distant vision follows

from other conditions than cataract. Through what mechanism does this treatment affect the nutrition of the lens or the elimination of its waste or both? Such results as these can only be accomplished in one or both of these ways. If we assume that it is a merely atheromatous contraction of the channels conveying the nutrition of the lens which is the cause of the cataract, we would not expect results such as we have lasting for many years from the mere dilation of these channels resulting from a hyperæmia which lasts for only a few weeks. We would expect the atheromatous condition to recur rapidly as it does in other structures. It seems to me, that, to explain these facts, we must assume that a special pabulum for the nutrition of the lens is metabolized by some of the cells in the ciliary region and that the cause of cataract is that these cells have assumed a pathological condition and issue a pabulum which is not physiological and not fit to maintain the physiological nutrition of the lens. The result of the treatment would imply that the hyperæmia induced re-establishes the physiological condition of the metabolizing mechanism. I think the existence of such a mechanism will not be disputed.

This of course is speculation, but speculation with facts behind it. The influence of a hyperæmia in other regions of the body are beyond the domain of doubt. Similarly the influence of local blood letting which is very closely allied to that of artificial hyperæmia.

The influence of local blood letting over a painful acutely congested liver is very marked. I have explored with a trocar a large and painful liver for abscess a number of times and failed to find one. The result was the escape of four to five ounces of blood and I was agreeably surprised next day to find that the patient was relieved of all his trouble and continued to be so.

This question of cataract opens up a wide field for the physiologist and I hope that physiologists will devote more attention to the nutrition of the lens and the vitreous than they have done in the past.

PTOSIS: I need not dwell on the large number of operations devised for the treatment of ptosis which are familiar to you all further than to say that the largeness of the number and the fact that very few operators are satisfied with the same opera-

tion are indications that not one of them is satisfactory. In my personal experience such is the case.

In India the indigenous ophthalmological quack does an operation for trichiasis and entropion which very frequently suspends the upper lid high enough for the requirements of ptosis. He simply excises a large portion of skin from the upper eyelid and stitches it up. It struck me that a modification of this proceeding would be efficient for ptosis.

Rhinoplasty, as we do it in India is the indigenous quack surgeon's method modified and put on a scientific basis. It is hitherto undoubtedly superior to any other rhinoplastic proceeding devised, we should not be above taking a lesson from anyone.

The following modification I have tried frequently and I am satisfied that it is simpler, more efficient, and leaves less scarring than in any of the other operations.

I remove an ellipsoidal piece of skin the whole length of the eyelid, a little larger than we remove in entropion operations. The lower part of the excision runs close to the eyelashes. I now proceed with a dissector and a pair of dissecting forceps to separate the orbicularis muscle from the tarsal cartilage and the anterior part of the fornix from end to end and I continue the separation upwards and forwards till I reach the periosteum at the front margin of the orbit. I now pass in four stitches, one at each end and two between, through the eyebrow and underneath the orbicularis and lift the anterior portion of the fornix on the needles. I now spit the tarsal cartilage with each needle bringing it out in front of the eyelashes and tie the stitches over a small roll of bandage material. The stitches are taken over at the end of eight or ten days. I think, gentlemen, that you will find that this procedure is more satisfactory than any of the other operations so far devised. It is also very simple to perform. The principle involved is plain. It not merely suspends the eyelid mechanically, but brings the frontalis muscle to bear on it freely without paralysing in any way the orbicularis muscle.

AFTER-CATARACT:¹ The subject I propose to bring forward for discussion is the treatment of after-cataract. For the mild-

¹ Read at meeting of American Ophthalmological Society, Swampscott, June, 1921.

est form of after-cataract needling is generally recognized to be efficient. There are many needling methods advanced with very little to choose between them. In skilful hands any one of them seems as good as another. It is the more severe forms of after-cataract with which I propose to deal to-day. We are all familiar with the fact that needling is not satisfactory in the case of dense after-cataract. In these cases the iris is considerably tied down to the after-cataract. When an opening is made in them with needles they have a very great tendency to resent our interference by flaring up with a violent inflammatory reaction. In any case they generally require to be needled several times before a permanent opening is secured. After each needling the opening we make tends to close up again. The inflammatory reaction which is very liable to follow in severe cases often results in the destruction of the eye. Needling in any case (mild or severe) is not the very innocent proceeding which many would have us believe. In the last decade of the last century and in the early years of this century needling was regarded as serious an operation as extraction of cataract. The same methods and the same precautions were taken then as are taken now. The trouble in my opinion is not due to direct sepsis; there are more evils in the world than sepsis. The more the iris is tied to the after-cataract by inflammatory adhesion, the greater is the inflammatory reaction following needling. The most severe form in after-cataract according to my observation follows the extraction of immature cataract by the capsulotomy method and follows the needling of the jelly-like type of cataract which we often find in children and growing people. This stringy jelly-like material does not seem to be absorbed after needling. I have come across cases in children and adults operated on by the above two methods with very dense after-cataracts, with the pupillary margin tied down all round to the after-cataract. These cases had had a long course of after-treatment and when leaving had been told that nothing further could be done and that the prospect of vision was hopeless.

Many of them had been operated on by highly skilled operators. These experienced operators had properly come to the conclusion that any needling interference would cause such an inflammatory flare-up as would in a few days utterly de-

stroy the eye. These patients or their people were usually intelligent and often came from very long distances. The unintelligent would have accepted the verdict that there was nothing more to be done, they were prepared to take risks as they had no other prospect but to remain blind. In these cases there is always a posterior chamber. I do not interfere with them till all inflammatory reaction has settled down. I put them under the influence of a grain of blue pill four times a day and continue for a few days after operation, in order to anticipate any further reaction induced by my interference. I atropinize them heavily before operation. I make a liberal sized iridectomy incision in the sclero-cornea so as to open up the posterior chamber. I do an iridectomy if one has not previously been done. If one has been done already my wound is over one of the pillars of the coloboma, so that I can get a piece out of the iris there and thus open up the posterior chamber. I now insert a curved, small dissector into the posterior chamber and separate the iris from the after-cataract all round. This is not a difficult matter as such adhesions are much less strong than the uninitiated would expect. This interference is associated with free bleeding from the iris which must be squeezed out repeatedly until it has ceased. It will now be observed that the atropine previously instilled has dilated the pupil; at this stage I reach in a good iris forceps to below the equator, allow its points to dilate widely, and press them into the after-cataract and fetch the whole after-cataract out with the forceps. If any pain follows within the next few days, I apply half a dozen leeches to the temples. There is no procedure in surgery with which I am more satisfied than this one and none more surprising to the patient. The results are eminently satisfactory, the pupil is again mobile, and the vision good. There was no one more astonished than myself in my first cases to see that this intervention was associated with little or no inflammatory reaction. In my opinion in the relatively milder types of after-cataract the same proceeding should be adopted. The attachments of the iris to the after-cataract if not released as in the needling methods are the cause of the inflammatory flare-up which is often so destructive.

DISCUSSION ON THE DIAGNOSIS AND TREATMENT OF CONGENITAL SYPHILIS.¹

ABSTRACTED FROM THE " PROCEEDINGS " OF THE ROYAL SOCIETY OF MEDICINE BY MR. P. G. DOYNE, LONDON.

SIR HUMPHREY ROLLESTON in opening the discussion said that he would confine his remarks almost entirely to diagnosis and would suggest the following points for consideration:

1. The limits of the Wassermann reaction as a means of diagnosis.
2. The influence of congenital syphilis:
 - a. In favoring the onset of other infections.
 - b. In leading to changes in the endocrine glands and so indirectly to syndromes which were not necessarily specific.
 - c. In relation to diseases or syndromes which were not generally regarded as due to syphilis and were not obviously secondary to lesions of the endocrine glands.
1. Except at birth, when a positive Wassermann reaction did not necessarily mean the presence of syphilis, a positive Wassermann reaction indicated the presence of living spirochætes and the need for anti-specific treatment. The converse did not hold good however. The reaction might be negative for several weeks in a newly-born infant and then become positive. At puberty the reaction often became negative though spirochætes were still present. He threw doubts on the value of the "provocative dose" of salvarsan and mentions observations in definitely non-specific cases in which an intravenous injection of salvarsan produced a positive reaction. In some cases the present symptoms would be due to damage to an organ by syphilis in the past, and the question

¹ Held at the Section for Study of Disease of Children, Royal Society of Medicine, London.

would arise as to whether, in the face of a negative reaction, anti-specific treatment was necessary. He especially referred to insufficiency of the endocrine glands and the blood forming organs in this connection. At the present moment it appeared to be impossible to accept as absolute the proposition that, in the presence of syphilitic stigmata, a negative reaction of the blood eliminated the possibility of existing syphilitic infection. The Wassermann reaction might be positive in the cerebro-spinal fluid and negative in the blood. This might especially be the case in syphilitic disease of the pituitary and in pituitary dystrophies the true aetiology of the condition might be missed if the reaction of the blood only was taken. But even in the absence of syphilitic stigmata and with a negative reaction could syphilis be absolutely ruled out when no other history or sign of past infection or any other kind of infection could be found?

It should always be borne in mind that apart from the specific effect anti-syphilitic drugs had a beneficial effect upon the body and upon the endocrine glands and blood forming organs in particular.

2. Congenital syphilis as a predisposing factor to other infections. It was important to bear this factor in mind as otherwise the acute exciting factor might put into the shade this underlying factor. Acute infections of the liver and hemorrhagic diseases of newborn infants are to be considered in this connection. Also syphilis, by reducing resistance, paves the way for secondary infections of chronic character, for example tubercle of lymphatic glands in a syphilitic subject.

The influence of syphilis in leading to lesions of the endocrine glands and so conduced to syndromes which were not necessarily syphilitic.

The adrenals, pituitary, and the testes were the endocrine glands most often affected in congenital syphilis. As regards the testes Sir Frederick Mott had suggested that a chronic spirochaetal intoxication might depress their vital energy. Infantilism was common in congenital syphilis. Addison's disease and myxoedema were uncommon in congenital syphilitic children, but slighter degrees of insufficiency were common. A certain proportion of cases of pluri-glandular insufficiency causing diabetes and infantilism were probably due to congeni-

tal syphilis. Again in obesity of endocrine origin congenital syphilis played its part.

The influence of congenital syphilis in relation to various diseases which were not generally regarded as due to syphilis and were not obviously due to lesions of the endocrine glands. (Chronic interstitial nephritis in early life.) Congenital syphilis might be a factor in producing chronic interstitial nephritis in several ways. The diffuse small-celled infiltration might either advance to fibrosis or disappear leaving behind a diminished resistance which would make the organ a prey to other factors which could produce the change. The widespread arterial change might produce an arterio-sclerotic kidney. By damaging the endocrine organs the resulting metabolic disturbance might subsequently lead to kidney changes. This might have a bearing on those cases of renal dwarfism in which the Wassermann reaction was negative. In portal cirrhosis there were cases which showed the stigmata of congenital syphilis. Chronic pericolitis with adhesions and peri-enteritis causing chronic abdominal symptoms had been considered in part a late result of congenital syphilis. Syphilis was a potent cause of anaemia in early life, but should be regarded as only one of the factors of infantile anaemia. Mitral stenosis had been thought to be a malformation due to the influence of congenital syphilis. In Great Britain congenital syphilis had not been accepted as a cause of rickets but indirectly by its influence on the endocrine glands might modify nutrition. Regarding malformations, the question arose as to how far the intrauterine activity of congenital syphilis was a cause of these defects. It was certainly not the exclusive cause but it was possible that in this country it had been underestimated as a factor.

MR. O. L. ADDISON dealing with the surgical aspect of congenital syphilis took into consideration two age periods (I) infancy (II) after infancy. (I) With the exception of "snuffles," osteomyelitis of the long bones was the one common surgical lesion. It was most often seen at the age of three months and affected all the long bones of the arms and legs, the condition being generally more advanced in the arms. X-rays and the age of the patient afforded a ready means of diagnosis. The X-ray photographs were characteristic show-

ing the periosteum raised up from the shaft by a deposit of new bone and large areas of absorption, most marked at the ends of the diaphyses. The name "epiphysitis" for the more advanced cases was misleading as the changes were most marked at the ends of the diaphyses. He had not seen syphilitic arthritis in infants unassociated with osteomyelitis. Cases of renal insufficiency associated with multiple fractures showed X-ray appearances not unlike late quiescent cases of syphilitic osteomyelitis but the presence of albumen in the urine and a negative Wassermann revealed the correct diagnosis. Next in order of frequency came Orchitis. Common at birth or in the first month, it occurred as a hard painless enlargement usually symmetrical and accompanied by a small hydrocele.

(II) In the "after infancy period" bone and joint affections were the most frequent manifestations. Periostitis occurred at 3-4 years or later and was diffuse or localised, the former giving rise to the "saber" tibia and latter to nodes. Both were commonest on the tibia. General osteomyelitis was less common. It gave rise to a great increase in amount and thickness of the compact bone with areas of softening and with the formation of sequestra in the medulla. Regarding the joints, gummatous synovitis was common and was difficult to diagnose from tubercle. The more rapid recovery of movement after the removal of splints and the greater overgrowth of bone were distinguishing features. Symmetrical serous effusions, usually affecting the knee-joints, were common but chondro-arthritis was rare. Rarer affections, occurring at this age, consisted in gummata in muscles skin and subcutaneous tissues, ulceration of the palate and chronic enlargement of the glands of the neck.

Regarding diagnosis, he pointed out the great difficulty, in the absence of cardinal signs of congenital syphilis, in differentiating many of the lesions from tubercle and advised the performance of a Wassermann reaction as a routine measure.

SIR FREDERICK MOTT dealt with Juvenile General Paralysis and Tabo-paralysis. He was convinced that syphilis was the cause of it. Of the cases of juvenile general paralysis which he had collected, about half showed signs of congenital syphilis, and a specific family history was discovered in the majority of cases. He had examined the testes in these cases, and

found that they had the appearance of the testes at birth except that the interstitial cells of Leydig were absent. This absence probably was related to the infantilism which occurs in these cases. In some histories of cases of juvenile paralysis of the insane, miscarriages, abortions, and deaths in the earlier pregnancies were followed by juvenile paralysis of the insane occurring at puberty, in the later born children and this suggested an attenuation of the virulence of the spirochæte by the action of antibodies in the mother.

DR. LEONARD FINDLAY (Glasgow) emphasized the value of the Wassermann reaction as carried out in the original technique in the diagnosis of congenital syphilis. He produced figures in which the results of the Wassermann reaction were compared with the clinical diagnosis, and showed that they were in striking agreement. The condition of marasmus was often said to be not infrequently the manifestation of syphilis. He did not consider that there was any adequate evidence for this view.

He had the impression that congenital syphilis was not so common as was generally thought. He did not think that examination of the umbilical blood was a certain test, and he was favorably impressed with the ante-natal treatment of the syphilitic mother, when such treatment was instituted before the ninth month of the pregnancy. He considered that a negative Wassermann reaction statistically meant freedom from the disease, but he did not assert that a negative reaction and complete destruction of spirochætes were synonymous. Treatment by mercury alone stood condemned, but with the advent of salvarsan and its application along with mercury a great reduction in the mortality rate was obtained.

DR. DAVID NABARRO said that his experience was gained at the Children's Hospital, Great Ormonde Street, and he was fortunate in that he took the blood, did the Wassermann test, and treated the cases. He was at the present time using neokharsivan, giving intravenous injections into the arm or external jugular vein, or intramuscular injections if a suitable vein were not forthcoming. He used simple watery solutions of the drug for both kinds of injections. For infants under one year of age he used an initial dose of 0.5 grm., increasing to 0.15 grm., and for larger children, 0.1 grm. to 0.45 grm. The

course consisted of 6 weekly injections with simultaneous mercurial inunctions. The condition was checked by Wassermann tests and the course repeated if necessary. He had great faith in the Wassermann reaction when reliably done. It must be remembered that a positive Wassermann reaction did not prove that a particular lesion was syphilitic. A negative reaction did not preclude syphilis. Very young children might give a negative reaction, so that he always tried to test the mother's blood. The mother's blood was nearly always positive when the child's was positive, but often the father's was negative. Congenital syphilitic children were undoubtedly benefited by treatment (arsenic and mercury) but it was too early to say that they were cured. In congenital syphilis it was difficult to make the Wassermann reaction negative. In 62 treated cases the Wassermann reaction had become negative in only 14, and in 5 of these it had since become positive again. He strongly urged ante-natal treatment.

DR. AMAND ROUTH. The infantile deaths of syphilitic children occur chiefly at two periods. (1) During the first week or two after birth. (2) Later on in the first year, when congenital syphilites, born apparently healthy, became clinically syphilitic. He urged early treatment of the syphilitic mother, not only during her pregnancy but until cured. He referred to the condition of latent syphilis in pregnancy, due to the action of the syncytial toxins upon the spirochæte. The child might be born apparently healthy, but as the syncytial toxins disappeared from the tissues after birth, the spirochæte would develop. In a few cases the syncytial toxins might completely destroy the spirochæte, thus accounting for the occasional birth of a healthy child amidst a series of still births or infected children.

MR. BISHOP HARMAN produced statistics from the London schools for the blind and partially blind. He divided the cases according as the major effects of the syphilitic changes affected (1) the anterior parts of the eye, (2) the posterior. Often, of course, inflammatory effects were found in both areas, but the division, though arbitrary, was interesting. In making this classification confirmatory clinical signs of congenital syphilis were noted. It was interesting to observe that the most serious general symptoms were found in those cases in

which the disease, as far as the eye was concerned, was most marked in the posterior parts of the eye. This was especially marked among the mentally defective children. Though children, subjects of interstitial keratitis, were often dull and backward, no cases definitely returned as mentally defective were among this group. The reverse was the case with children who had disseminated choroiditis.

DR. MORLEY FLETCHER had the impression that the type of the disease seen in infants was changing. Infants with frank manifestations of syphilis were less often seen. This might be accounted by (1) that the infection was of milder type, (2) that resistance to infection was gradually increasing.

He felt that the Wassermann reaction, performed by competent pathologists, was of great value, though it was to be understood that a negative Wassermann reaction the result of treatment, did not necessarily mean that the disease had died out. Regarding the value of the provocative dose, he had not seen a single case where a positive reaction had followed a provocative infection. Resistance to infection was lowered in syphilitic children. There was a close association between syphilis and tubercle and cases of tubercle occurring in congenital syphilis were much benefited by antisyphilitic treatment. He would emphasize the possibility of lowered efficiency of the endocrine glands caused by previous syphilitic disease in them, and would draw attention to the important relationship which congenital syphilis might bear to kidney disease. It would be interesting to know what proportion of cases of fibrosis of the lung gave a positive Wassermann reaction.

Regarding treatment, it was generally agreed that intravenous injections of arsenical compounds combined with mercury was the method of choice. But he would point out how tolerant of mercury children were, and he did not think that the best results were obtained unless large doses were given.

MR. JOHN ADAMS urged the ante-natal and immediate post-natal treatment of syphilis. In children the effect of salvarsan was remarkably rapid. He mentioned the case of a woman, 7 months pregnant, who became infected with syphilis. She had no treatment and developed generalised syphilis at full term. The child born gave a negative Wassermann reaction.

For the sake of information he was watched and not treated. The Wassermann reaction remained negative. He would account for this by the action of the syncytial toxins mentioned by Dr. Routh. The reason why congenital syphilis was a comparatively rare disease was because 50% of all syphilitic foetuses were born dead and 75% of those born alive died within the year.

DR. JEWSBURY produced statistics from the children's department of St. Thomas's Hospital.

With regard to the incidences of the disease in families as it affected children born of syphilitic parents. In about 50% the disease was most marked in the earlier pregnancies, becoming attenuated later on. But in the other 50% children apparently free cropped up irregularly amongst definitely syphilitic children. He mentioned a case of twins, 5th and 6th in the family, of whom one was obviously syphilitic with positive Wassermann reaction, and the other showed no sign of syphilis and the Wassermann reaction was repeatedly negative up to 6 years of age. A few children of syphilitic mothers who had not been treated were free from signs and had a negative Wassermann reaction; many children had shown the usual signs of congenital syphilis in whom rash and snuffles appeared 2-8 weeks after birth. In certain numbers of children symptoms developed late, after the 3d or 6th year. He had found the Wassermann a reliable test.

MR. J. E. R. McDONAGH. If a woman contracted syphilis while pregnant, up to the end of the 5th month, the child would be syphilitic. During the 6th and 7th months 50% of the children would be syphilitic, but during the 8th and 9th months the child would probably escape.

If a woman contracted syphilis before being pregnant, non-syphilitic children were most likely to occur in the middle of the family. Such a woman should, however, be treated throughout the whole of each successive pregnancy, irrespective of the amount of treatment she had already undergone.

If the mother underwent treatment during the whole term, the children would be born healthy, but, in his experience, even these children were liable to develop the later forms of the disease.

A negative Wassermann reaction could not be held as signi-

fying that the child was not syphilitic, and as against this a positive Wassermann reaction, given by a child at birth, was not proof positive that the child was syphilitic if the mother had not contracted the disease until the 8th month of the pregnancy.

He thought that in the future less early congenital syphilis, but more late congenital syphilis, would be seen, especially of the nervous system.

MR. NOAME and MR. WOODHEAD described the results of the treatment of 38 consecutive cases of interstitial keratitis. Only those cases who showed the presence of deep vessels in the cornea, and who had had a positive Wassermann reaction on one or more occasions since the onset of the disease, were accepted as interstitial keratitis. Treatment consisted of courses of intravenous injections of novarsenobillon or disarsonol, mercury by the mouth and atropine to the eye.

Of the 38 cases, 24 had only reached the stage in which visual acuity could be examined. Of these 24 only 5 had vision worse than $\frac{1}{6}$. In 7 cases the disease started in the second eye during and after the use of arsenic injections.

In conclusion they doubted whether arsenic combined with mercury could prevent the second eye from becoming affected. They thought this treatment had a definitely beneficial effect on the choroid and on the corneal condition when the disease was established.

MR. A. T. PITTS. The teeth which show characteristic modifications in congenital syphilis were the upper central incisors (Hutchinson's teeth) and the first permanent molars (Moon's molars).

The notching of the central incisors would seem to be a true hypoplasia due to some interference with the calcium metabolism and was comparable with the hypoplasia of rickets. It must be remembered when using the notch as a diagnostic point, that at times it was absent, and reliance should be placed chiefly on the narrowing of the cutting edge. The first molars showed a diminution in breadth towards the masticating surface and the cusps were stunted and rounded. Regarding the milk dentition, it was doubtful whether there was any condition of these teeth which could be called pathognomonic of congenital syphilis. It must be remembered

that the calcification of the deciduous incisors began at the 16th-18th week of intra-uterine life. Syphilis attacking the foetus at this early stage would be likely to cause its death. However hypoplasia of the milk teeth was most probably associated with congenital syphilis which interfered with the calcium metabolism.

DR. RONALD CARTER said that his impression was that congenital syphilis was a comparatively rare disease. He mentioned figures from one of the municipal infant departments, which made out that congenitally syphilitic infants were more liable to attacks of intercurrent disease. He thought these figures fallacies as they were not backed by pathological findings.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By MR. H. DICKINSON, LONDON.

The opening meeting of this Section was held on the 14th of October, the President, DR. JAMES TAYLOR, occupying the chair.

Models Illustrating the Development of the Human Eye.

MISS IDA C. MANN showed a series of well-executed models to illustrate the development of the eye. For teaching purposes she regards them as superior to ordinary book illustrations.

Case of Probable Implantation Cyst.

MR. L. FLEMING exhibited a girl who, 18 months ago, received an injury to the eye. When she was seen six months after the receipt of the injury there was a perforation at the limbus, the iris was adherent, and there was active iritis present. Six months later a small nodule appeared at the nine o'clock position, but since that date there had been no appreciable increase in size.

MR. TREACHER COLLINS did not feel certain as to its nature, but suggested that the diagnosis might be helped by employing contact illumination.

Gray Mass in Vitreous.

MR. BOOKLESS showed a child with a gray mass in the vitreous with arborization of vessels visible at the back of the lens. A week after being seen, a small nodule appeared on the back of the iris. This had progressively increased, and vision was

reduced from $\frac{1}{6}$ to perception of fingers at a distance of a few inches. The diagnosis seemed to rest between a congenital abnormality and malignant disease.

SIR WILLIAM LISTER considered that it was a cyst of the iris, with a membrane which had formed after the occurrence of hemorrhage in the vitreous. He did not regard the condition as malignant.

MR. M. S. MAYOU referred to a case he showed at a previous meeting, in which there was a similar appearance, but without a membrane. He agreed that the present case was one of cyst of the iris.

MR. TREACHER COLLINS considered that the primary factor was the cyclitis, which had produced a cyclitic membrane. This membrane probably caused an arrest of lymph circulation, which had resulted in the separation of the two layers of pigment at the back of the iris, a cyst having been caused by that. He advised puncture of the body, which, he thought, would probably bring about its collapse.

Case of Benedict's Syndrome.

DR. WYLIE SEND and MR. LESLIE PATON demonstrated a case of Benedict's syndrome. The lesion was supposed to be in the red nucleus, catching the fibers of the third nerve.

The Fourth Cranial Nerve.

MR. J. HERBERT PARSONS, F.R.S., gave a contribution on what he termed the riddle of the fourth nerve, the only nerve which had, in a complete sense, a dorsal decussation. It was probable, he said, that there were no decussating fibers within the central nervous system other than those passing out in the trunk of the nerve. A peculiarity of the fourth nerve was, that it was purely somatic in mammals; it supplied purely somatic muscles, and had no visceral fibers. There was an absence of experimental lesions in this neighborhood sufficiently exactly localized to produce definite results. Explanation, therefore, must be sought in comparative anatomy and embryology. The 4th nerve existed all along down to the lowest vertebrates, as shown in a slide it was found even in the lamprey, in which animal the eyes were very degenerate

organs. The 4th decussated dorsally, going through the anterior medullary velum in that animal, exactly as in the higher vertebrates. He exhibited slides illustrating the work of Davidson Black, showing the position of the nuclei of the cranial nerves and their points of exit from the central nervous system. The same kind of thing was seen in various specimens of amphibiae. Cappi believed that migration of motor nuclei was especially associated with chemio-taxis, due to the attraction to foci of incoming afferent impulses; and the last edition of Sir Arthur Keith's "Embryology" explained the 4th nerve as due to neuro-biotaxis, but as to this view Mr. Parsons expressed his scepticism. Still, there was no doubt of the fact that in the evolutionary process the afferent side became evolved very much in advance of the motor response. Mr. Parsons pointed out the near association of the fibers of the 4th with those of the 5th nerve at a very early stage of their development, both as to the relation of their branches and in regard to the ciliary ganglion. Investigation of the chief ganglion of the 4th nerve showed that it did not migrate from the motor part, but developed from the cells which were on the neural crest. There could be no doubt that this ganglion on the 4th was a posterior root ganglion, and that, certainly at this stage, the 4th nerve had motor somatic fibers in addition to sensory somatic fibers. He showed that complex synergic movements existed, brought about by nerve nuclei, with fibers which, presumably, decussated, and which were correlated with each other in a remarkable way in the absence of cerebral hemispheres. Therefore it must be concluded that even at a low stage there was an arrangement for coördinating the synergic movements of the eye muscles. Coöordination was usually regarded as entirely cortical, and sufficient stress had not been laid on lower coördination centers. This idea did not detract from Hughlings Jackson's view; it merely divided Jackson's "top story" into a series of flats.

DR. GORDON HOLMES discussed the contribution.

Milestones in Refraction Work.

MR. ERNEST CLARKE read a paper on this subject, based upon forty years of ophthalmic work. He said that at the

date he commenced to practise, it was rare to correct any astigmatism under .50 D., or $\frac{1}{16}$ th of an inch. He passed his first milestone when, in his first year, he attended Donders' clinic at Utrecht, where more attention was being paid to refraction. In the Netherlands the diopter was thoroughly installed, whereas in London oculists were still prescribing in inches. An enormous debt was due to Donders for clearing up the subject of refraction and raising that department to a scientific level. His work, published in 1864, is still a classic; and though some of the statements had since been amplified, none had been negatived. At that date, too, retinoscopy or skiascopy had not become universal. The realization of the all-embracing and deleterious effects of eye-strain had taken many years; it was now known that there was scarcely any nerve trouble which might not be due, in whole or in part, to eye-strain. In this matter it was the small errors which counted. Still, symptoms commonly attributable to eye-strain might owe their origin to nasal or dental trouble. The skilled ophthalmologist would look for extra-ocular as well as ocular causes. If a young person had an error of refraction, the correcting glasses should be worn always in the house, though not necessarily at games out of doors. If this were done, the tendency was for small errors to disappear. Admittedly the wearing of glasses by the public school boy was a great disability.

Donders proved that presbyopia was not the opposite of myopia. Mr. Clarke had collected the records of 750 cases of myopia observed by him in the last 14 years. No case of high myopia with fundus changes was included, and all the cases given were treated by full correction, only allowing weaker glasses for near work in patients who were approaching the presbyopic period. The results were as follows: 101 showed a decrease in the myopia with the advance of age, and of these, 83 were over 30 years of age; 379 remained stationary, and of those, 306 were over 20 years of age. In 141 there was an increase in the myopia up to, but not exceeding, .50 D.; 129 increased in myopia .75 or more, and of these, 78 were under 15 years of age. Only 16 of the 750 increased over 2 D., and the maximum of 4 D. was reached by 5 patients. The common-sense treatment was to try to make the patient

normal by giving full correction of the myopia, and insisting that the glasses shall be worn for every purpose within doors; in this way the ciliary muscle was trained to do its proper work without undue convergence. Donders's best work was, probably, in association with presbyopia, yet it took years for his teaching to bear fruit. Every presbyope must be carefully examined, his static refraction ascertained, also his accommodation power, and with that knowledge one could safely give him an addition for near work. The correct treatment of presbyopia was one of the most important duties of the oculist, because these patients had arrived at a critical period of life, when they had many worries, and often were subjects of intestinal toxæmia, making it necessary to stop every channel of nervous waste. If it were found, by static refraction, that eye-strain was present, distance and near glasses should be prescribed.

Mr. Clarke had seen a great change in the attitude towards cycloplegics. In early days atropine was the drug used, and at that date it was used excessively, but only for the young. To arrive at the truth it was necessary to test with and without a cycloplegic. He had done that in reference to a large number of patients: *i.e.*, he put the patient through a complete objective and subjective examination and selected the glasses; then he had put him under atropine, or homatropine, and put him again through examination. In some of the cases the cyoplegia revealed nothing new, though in a large number it showed an important difference, a difference which would decide between success and failure in treatment. The oculist's note-book should record patients' static refraction, and in the majority of cases that could only be got, in a patient under 40 years of age, by using a cycloplegic. Once he had record of a patient's static refraction, he did not again put that patient under atropine. In the whole 40 years he had never had a case of glaucoma produced by a cycloplegic.

With regard to heterophoria, he spoke highly of Maddox's useful glass-rod test. He agreed with Maddox's opinion that small heterophorias tend to disappear when the error of refraction is properly corrected and the glasses worn. He referred also to the great improvement in the treatment of squint in recent years. He had praise for Meyrowitz's latest model of

ophthalmometer; it was, he said, a very accurate instrument, and a time-economizer. He touched also on the types of trial frames, and concluded with a comment on the three cardinal maxims which were given him by his old master Luther Holden: (1) Think of your patient first; (2) think of your profession second; (3) think of yourself last.

DR. McCREA, speaking as a physician, emphasised Mr. Clarke's remarks as to the need for correcting slight errors of refraction; he had found them a prolific cause of the commonest symptom encountered by physicians, headache. With regard to cycloplegics, he, the speaker, did not care to read a report on a patient under 45 on whom a cycloplegic had not been used. He thought physicians should get more frequently into touch with such specialists as ophthalmologists.

MR. HARRISON BUTLER said he now seldom used mydriatics, and he believed he was getting considerably better results; his change of view he owed to his lamented friend Devereux Marshall. He suggested that some of the younger men might investigate how far the statement that the eyes were always changing with advancing years was true. He had discovered that certain patients got an alteration of the angle of astigmatism from time to time. With a certain type of cornea slight alterations might occur which varied the intraocular tension.

MR. ERNEST CLARKE, in his reply, said he was certain the refraction was constantly altering.

REPORT OF THE PROCEEDINGS OF THE SECTION
ON OPHTHALMOLOGY OF THE NEW YORK
ACADEMY OF MEDICINE

BY DR. CONRAD BERENS, JR., SECRETARY

MEETING OF OCTOBER 17, 1921. DR. L. W. CRIGLER, CHAIRMAN

Professor Ernst Fuchs of Vienna read a paper on **Presbyopia** which appears in this issue of the ARCHIVES.

DISCUSSION

Dr. ALEXANDER DUANE: The subject of presbyopia covers so many matters deserving consideration, that one cannot touch on them all. I shall consider only a few that have special reference to Dr. Fuchs's interesting paper.

1. Not only the experiments of Hess but also those of Gullstrand on intra-capsular accommodation, demonstrate the truth of Helmholtz's explanation of accommodation as consisting of a passive relaxation of the lens rather than a forced dilatation of it, as described by Tscherning.

2. That the accommodation in presbyopes is actually of the amount indicated in the tables, *i.e.*, 1 or 2 D. or sometimes over, has been disputed, it being argued that the older patients see distinctly without using accommodation, because they contract their pupils to a stenopæic aperture. But this is certainly not so. I have made many measurements in such presbyopes, in whom the pupils were 3mm or so, and in whom there could be no question but that the accommodation was a genuine one.

3. Hess's conception of the difference between manifest accommodation, and what Dr. Fuchs happily terms physiological accommodation—*i.e.*, between the manifest increase of

refractive power produced by distension of the lens and the contraction of the ciliary muscle that causes that increase—seems almost unavoidable if we accept the Helmholtz theory. And yet, as I have repeatedly pointed out, there is a stumbling block in the way of its acceptance. Thus suppose we have three subjects, aged respectively 10, 30, and 41, having, all three, an amount of ciliary muscle energy (physiological accommodation) equal to 17 D. Owing now to the differing state of their lenses, the first has an accommodation (manifest or physical accommodation) of 14 D., the second one of 9 D., and the third one of 5 D., so that the amount of latent or unused ciliary energy in each is respectively 3 D., 8 D., and 12 D. Suppose further that we paralyze the ciliary muscle in all three with a gradually acting drug like homatropine. Obviously the latter will have to abolish all the latent ciliary energy before it produces any effect on the accommodation, that we can appreciate. It should therefore have a very different effect on the three persons. As the diagram, taken from an average case representing the action of homatropine in a young subject, shows, it should produce an appreciable effect in the boy of 10 in between 6 and 12 minutes, but in the man of 30 not till between 22 and 25 minutes, and in the man of 41 not till 35 minutes or later. Now repeated experiments that I have made show that the paralysis of accommodation produced by homatropine will begin to be apparent at about the same time in all three, namely in about 10—at any rate before 15 minutes. This would seem to indicate that the amount of latent accommodation in cases 2 and 3 is not as great as the Helmholtz theory as interpreted by Hess would indicate.

4. As Dr. Fuchs says the amount of physical accommodation put forth by a presbyope is known, since we can measure it, but the actual fraction of physiological accommodation exerted in performing an act of convergence is not known. I should certainly agree with Dr. Fuchs in thinking, in opposition to Donders, that the physiological accommodation exerted corresponds to the convergence, *i.e.*, that a man of 55 who with the aid of glasses is able to converge to a point 33 cm from the eyes is using 3 D. of physiological accommodation (contraction of the ciliary muscle) even if only 1 D. of this can be utilized for the expansion of his lens. A proof of this reciprocal

relation between the convergence and the physiological accommodation in presbyopes, indicated by Dr. Fuchs, is found I think, in the fact that regularly the binocular accommodation in presbyopes in which convergence is necessarily employed is greater than the monocular in which there is little or no convergence. I think also, however, that at the beginning of presbyopia the following happens. The patient having, say 2 D. of physical accommodation, has received a 1.25 D. glass and is thus able to see an object at about 30cm. In so doing he probably uses, as Dr. Fuchs says, 3.25 D. of his physiological accommodation, corresponding to a convergence of this amount. That is, he contracts his ciliary muscle to an amount which if the lens were perfectly fluid would increase its refractivity by 3.25 D. But if he lets up a little on this contraction he finds that he can still see distinctly, because with the help of the glass he actually needs only 2 D. of ciliary contraction to accomplish his purpose. This discovery tends to make him relax the contraction more or less continuously when reading. But in so relaxing he also tends to relax his convergence, *i.e.*, develop an exophoria for near. That this sort of relaxation both of the accommodative and convergence effort actually takes place seems evident from the fact that putting on reading glasses for the first time does seem to develop an increase of exophoria for near points and to such a degree sometimes as to occasion trouble. In fact, it is not unlikely that in these patients there is a sort of see-saw between a condition of relaxed accommodation with exophoria or actual crossed diplopia and a condition of sharper accommodation convergence with single vision. This alternation would be quite sure to produce some confusion and asthenopia.

Naturally the amount of trouble due to this sort of exophoria increases with the convergence of the eyes, and this increases with the strength of the convex glass added for near. Hence the fact which we soon learn by clinical experience, namely that we must be careful not to make our convex additions too strong. A little difference in this regard makes a great difference in the patient's comfort. It is often better to sacrifice sharp definition for comfort, giving, for example, a +1.25 addition with which a patient reads a little less clearly than a

+1.50 with which he soon gets a disagreeable sense of strain and pull about the eyes.

5. The actual determination of the best reading glass in presbyopia is greatly facilitated by testing the unioocular and binocular accommodation with the trial glasses on. As a rule, in presbyopes under 48 a glass which brings the unioocular near point closer than 25cm (4 D.) and after 48 one which brings it closer than 28cm. (3.5 D.) is not well borne. The binocular accommodation may be a little greater. Generally, too, it is worth while, in case the unioocular accommodation is different in the two eyes to see if any unequal addition for reading does not give a more comfortable glass.

6. That presbyopes especially at the outset suffer quite often from asthenopia and sometimes also from other troubles of which Dr. Fuchs speaks (micropsia, delayed adjustment for distance due to actual transient spasm of accommodation) is a matter very little considered in textbooks and one to which I am very glad he had called attention.

With respect to asthenopia in presbyopes, I believe this is a complex matter, in which probably several factors act. Very often, at any rate, I believe it is developed in the way already mentioned by the exophoria that is produced or exaggerated by putting on reading glasses for the first time.

Dr. Fuchs's explanation of the micropsia occurring sometimes in presbyopia and of the transient spasm of accommodation for distance seems absolutely in accord with clinical and physiological facts. The second of these two symptoms, I believe, is fairly common. If continuously troublesome it might possibly be relieved by diverging exercises with prisms with the test object at a near point.

DR. COLMAN W. CUTLER expressed the deep appreciation that all those present felt in listening to the clear presentation of a subject which is not without difficulty, although in the hands of Prof. Fuchs it seemed simple enough. Dr. Duane had shown that the accepted theory of accommodation was not quite adequate and it may be that the theory of Tscherning or some analogous explanation will have to be considered as an alternative to the theory of Helmholtz. After such an address and the very able discussion by Dr. Duane, there seemed little to say on the subject of presbyopia.

The presence of Prof. Fuchs recalled very vividly the great kindness of the Master and the many opportunities that he offered so freely to the beginner in ophthalmology in Vienna. Among the teachers of refraction, was recalled Dr. George Bull, of Paris, who strove to help the individual, realizing that refraction was a scientific art and not a mere routine. His patience and persistence in analyzing the needs of the patient had been a precious lesson. Prof. Tscherning, then at the Sorbonne with Javal, had made physiological optics clear, with a scientific imagination that was inspiring. Among our own teachers of the Scientific Art, the speaker desired to recall Dr. W. S. Dennett, whose humor and shrewd common sense, as well as his science, make him an outstanding figure, cherished in the memory of his friends. This digression may be pardoned, as it is well to recall the names, too easily forgotten, of those who have helped to make Ophthalmology what it is.

DOCTOR CHARLES H. MAY cautioned against the common mistake of prescribing glasses for presbyopia according to age and in disregard of the fact that, within certain limits, age must be considered as more or less relative. He thought that in general, there existed a tendency to prescribe stronger glasses for the presbyope than were needed or were comfortable. The presbyopic individual should be permitted some choice in the selection. Notwithstanding the fact that we are in the habit of assuming the non-existence of latent hyperopia after a certain age, such latent hyperopia does exist not infrequently and this has to be taken into account in the prescribing of glasses. Just as different individuals of the same advanced age show different degrees of general strength and robustness, so they differ as to the power of the convex lens which must be made use of for close work. Hence the presbyope should be allowed a certain amount of license in selection. It is often found that an increase of two inches in the reading distance commonly accepted as the standard results in less fatigue and greater comfort.

DOCTOR G. W. VANDEGRIFT suggested that presbyopia is a biological disharmony, being due primarily, perhaps to a degeneration of the ciliary muscle through the ages. If this is so it explains, also, weakness of the ciliary muscle found in myopia.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by DRs. A. N. ALLING, New Haven; M. J. SCHOENBERG, New York; T. H. BUTLER, London; P. G. DOYNE, London; and K. WESSELY (*Archiv für Augenheilkunde*), Würzburg.

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(Concluded from the November issue.)

VII.—THE ORBITS AND ACCESSORY SINUSES.

48. ERGGELET. *Pulsating exophthalmos.* *Deutsche med. Wochenschr.*, 1920, p. 447.
49. HAJEK. *Rhinogenous origin of retrobulbar neuritis.* *Klin. Monatsbl. f. Augenheilkunde*, lxiv., p. 559.
50. VAN DER HOEVE. *Mucocele of the sphenoidal sinus and posterior ethmoidal cells with atrophy of the optic nerve.* *Zeitschr. f. Augenheilk.*, liii., p. 223.
51. ISCHREYT. *Visual disturbances in consequence of orbital inflammations.* *Ibid.*, liii., p. 432.
52. LAUBER. *Bony tumors of the orbit.* *Ibid.*, iii., p. 216.
53. MELLER. *Retrobulbar neuritis, etiologically and therapeutically.* *Klin. Monatsbl. f. Augenheilk.*, lxiv., p. 556.
54. POLLEMS. *Local tumorlike amyloidosis in the orbit.* *Archiv f. Ophthalmol.*, ci., p. 346.
55. RUMBAU. *Lymphosarcoma of the orbit.* *Klin. Monatsbl. f. Augenheilk.*, lxiv., p. 795.

ERGGELET (48, *Pulsating exophthalmos*) reports a case of pulsating exophthalmos which resulted from a wound made by shrapnel. The common carotid artery had been tied elsewhere. A year and three quarters later exophthalmos and an easily palpable pulsation still persisted. A striking condition was the almost total lack of retinal vessels, which was ascribed to thrombotic processes and the effects of cicatricial contraction in the orbit upon the central artery of the retina.

HAJEK (49, **Rhinogenous origin of retrobulbar neuritis**) shows that pathological processes in the optic nerve are often caused by inflammations connected with the nose. The influence of dilatations of the ethmoidal labyrinth and of the sphenoidal sinus upon diseases of the contents of the orbit is not so certain. Anatomical preconditions to such diseases are present, for the ethmoidal cells often protrude so far that an inflammation there might be able to exert the same influence upon the optic nerve as an inflammation in the sphenoidal sinus. The true seat of disease is difficult to establish clinically, and pathological investigations are almost wholly wanting, yet one must be careful in making the diagnosis, as is shown by the case of Polyak in 1904, in which the condition was not one of empyema of the accessory sinuses, but one of myosarcoma, which started in the nose and injured the optic nerve through proliferation through the sphenoid. Inflammatory exudates or polypi of the accessory sinuses can exert pressure on the optic nerve. The writer refers to a case of his own of mucocele of the sphenoid, in which the optic nerve rapidly recovered after the mucocele had been emptied. He is of the opinion that it is not correct to assume a rhinogenous origin of an inflammation of the optic nerve when the changes in the accessory sinuses are slight, even when improvement follows a nasal operation. Several clinical histories are cited to prove that improvements and fluctuations of the vision occur when no nasal treatment has been undertaken.

VAN DER HOEVE (50, **Mucocele of the sphenoidal sinus and posterior ethmoidal cells with atrophy of the optic nerve**) reports a case of this nature. At the operation it was found that a tumor was present on the medial wall of the orbit, that the roof of the sphenoidal sinus had been destroyed, and that a probe could be passed to the dura. The latter fact precluded a more extensive operation. It could not be determined by the X-ray whether accessory sinuses on the other side were free or not. The varying symptoms in the visual field, the vision, and the muscles of both eyes, were referred to the fluctuations in tension and size of the mucocele. To all appearance the sphenoidal sinus was the first to become diseased. The ætiology was uncertain. The writer maintains that in cases of exophthalmos and disease of the optic nerve of doubtful

ætiology the accessory sinuses should be opened, whereby the diagnosis may often be cleared up and a proper treatment instituted.

Two of the cases reported by ISCHREYT (51, **Visual disturbances in consequence of orbital inflammations**) were of erysipelatous origin. The first case, that of a young woman 21 years old, was one of typical erysipelas. The right eyeball was protuberant, the vision badly impaired. The protrusion increased as the general condition became worse, and the cornea became cloudy because of the faulty closure of the lids. Little could be seen ophthalmoscopically, but the retinal vessels showed no special fullness. An opening above the eye into the orbital tissues failed to arrest the disease and the patient died with symptoms of meningitis. The second patient had had erysipelas eighteen months before. Since that time the vision of the left eye had been bad, and the pupil reacted only to accommodation. Both visual fields showed a large defect in the lower inner portion with no central scotoma. The ophthalmoscope revealed that both papillæ were pale, the left more so than the right. The veins were dilated and the right inferior nasal vein was thrombosed. The starting point of the orbital infection was in the lacrimal sac in the first case, not determined in the second. The injury to the optic nerves was probably due to toxines. In a third case the cause was inflammation of the antrum following extraction of a tooth. A subperiosteal abscess formed which broke externally. The antrum appeared to be free by the X-rays and by transillumination. An intermittent exophthalmos was caused when from time to time the abscess fistula became closed. The eye was blinded by optic atrophy, ascribed to the effect of toxines.

LAUBER (52, **Bony tumors of the orbit**) reports two cases of osteoma of the orbit. The first case was that of a man 37 years old, who for several months had suffered at times from very severe headache, exophthalmos, and loss of vision. Nose badly occluded. Examination showed exophthalmos of left eye, limited movements of the eye, tenderness of the left brow and temple. Ophthalmoscopically, left papilla much swollen, margins indistinct, arteries narrow, veins engorged. Vision, fingers at one meter. Visual field much contracted, especially

below and to the nasal side. The right eye had good vision, but the papilla was swollen, with indistinct margins, and the field was concentrically contracted. The X-rays showed an osteoma starting from the left ethmoid and extending into the left fossa of the skull, both nasal cavities and the left antrum. Removal of the tumor was followed by a normal healing. The position and movements of the eyes after operation were good. The right eye was normal, the left blind, a gray papilla with connective tissue changes and narrow vessels. The second case was that of a man 34 years old whose right was protuberant and displaced slightly downward, with slight limitation of mobility and occasional pain. A hard tumor could be felt between the eyeball and the nasal wall of the orbit. Vision, field, and fundus were normal. The X-rays showed a tumor as large as a nut in the orbit reaching to its roof. Operation was successful. The tumor originated from the ethmoid.

MELLER (53, **Retrobulbar neuritis**) discusses mainly the cases of retrobulbar neuritis in which a central scotoma is the only sign of the disease. The clinical pictures vary. Some begin acutely, some do not. Sometimes there is a history of coryza, headache, or sensitiveness to pressure on a nerve. If treatment of a disease of the accessory sinuses brings about a cure, the rhinogenous origin of the trouble is certain. The eye is often affected in non-purulent nasal troubles in which the rhinologist cannot positively exclude disease of the accessory sinuses. Even the thickening of the mucous membrane may cause trouble, so the ophthalmologist often desires nasal intervention. The nasal affection may pass away leaving the optic nerve trouble still existing; rhinogenous treatment is contraindicated in such cases. True recurrences of optic nerve disease are observed only in multiple sclerosis. There are many obscure cases which need to be cleared up through the coöperation of the ophthalmologist and neurologist.

POLLEMS' (54, **Tumorlike amyloidosis in the orbit**) patient was a woman 42 years old, who had had a swelling of the right upper lid for two years. Operation revealed a deposit of hyaline and amyloid in the connective tissue, and a hard, lobulated tumor three times as large as a bean between the roof of the orbit and the globe. The upper lid was swollen and slightly displaced outward and forward. In the inner

upper part of the left orbit could be felt a tumor as large as a bean. Microscopic examination proved the tumor to be composed of amyloid. The deposits of amyloid masses were enormous. The starting point could not be determined. The aetiology is obscure.

RUMBAU (55, **Lymphosarcoma of the orbit**) reports the case of a man 40 years old whose left eye became inflamed near the end of December, 1918. About three weeks later there was a distinct exophthalmos. The upper and outer margin of the orbit felt thickened. The diagnosis was made of empyema of the frontal sinus, the nose and other accessory sinuses being normal. At the second operation a tumor was found extending deeply into the orbit and adherent to the surrounding soft parts. It was removed in pieces, with a transient improvement of the exophthalmos. Although the general condition was found to be normal, mercury and seven injections of salvarsan were administered. The microscopic examination showed a diffuse round cell infiltration, gathered together in places in little masses, but no true tumor. Matters grew worse until the orbit was exenterated, leaving only a dense tumor layer in the lower part of the orbit. Radiation of this layer made it become smaller. There were no signs of leucæmia. Microscopic examination of the contents of the orbit showed that the tumor masses were particularly present about the optic nerve, gathered together in little heaps resembling lymph follicles. The musculature was permeated. The tumor tissue was very poor in vessels, the vessels unchanged. The pathologist pronounced the lesion to be a lymphosarcoma. The condition had to be differentiated from lymphoma, but exhibited certain clinical and microscopical changes which are to be met with only in true neoplasms. The starting point was uncertain; perhaps it sprang from an embryonal germ.

VIII.—THE CONJUNCTIVA

56. ALBERS-SCHÖNBERG. **Melanosarcoma of the corneal margin cured by X-rays.** *Deutsche Röntgengesellschaft*, Berlin, April, 1920.
57. BACHSTEZ. **A peculiar form of conjunctival ulcer.** *Ophthalm. Gesellschaft in Vienna*, March 15, 1920.
58. FRANKE. **Melanosarcoma of the limbus treated exclusively by the X-rays.** *Aerztl. Verein. in Hamburg*, May 4, 1920.

59. HIWATARI, K. The diagnosis of trachoma granules upon the limbus conjunctivæ. *American Journal of Ophthalmology*, March, 1921.
60. KRÜCKMANN. Cause of trachomatous ptosis. *Zeitschr. f. Augenheilk.*, lxiii., p. 305.
61. SANDER. Treatment of hay fever. *Aerzteverein in Stuttgart*.
62. TEICHNER. A case of ulcer of the conjunctiva involving the sclera. *Ophthalm. Gesellschaft in Vienna*, March 15, 1920.
63. UHTHOFF. Conjunctiva tarsi in vernal catarrh. *Ophthalm. Gesell. sch. in Heidelberg*, August 5-7, 1920.

According to SANDER (61, **Treatment of hay fever**) any treatment aside from symptomatic is harmful during the attack. Personal prophylaxis is important. Treatment with lime, aimed to produce a thickening of the mucous membranes, tends to prevent the absorption of the harmful pollen. Pollen vaccine has been used with good results in several cases. If intended as a prophylaxis, the treatment should be begun in the fall, or at latest in the spring, with slowly increasing doses. When the disease has already broken out, one may try to arrest it by large doses. The size of the initial dose and the measure of increase is determined through the intracutaneous reaction, which also serves for the rarely needed differential diagnosis from vasomotor coryza. The hypersensibility can often be reduced to 1/100 of that at the beginning.

UHTHOFF (63, **Conjunctiva tarsi in vernal catarrh**) exhibited preparations of the tarsal conjunctiva taken from a patient who had suffered from vernal catarrh for 35 years. The conjunctiva was much thickened and showed a layer of epithelial cells proliferated in the form of a network into the subconjunctival tissue. In the meshes of this was to be found newly formed connective tissue, vascular in places, and an extensive deposit of lime. Macroscopically the thickened conjunctiva presented a pale brownish appearance with flat, papillary unevennesses, permeated throughout with concrements of lime.

KRÜCKMANN (60, **Cause of trachomatous ptosis**) thinks the true explanation is the difficulty of moving the lids because of the swelling. In chronic cases the uncompensatable loss of elasticity, due to the changes in the deep tissues, furnishes a sufficient explanation.

In BACHSTEZ's (57, **A peculiar form of conjunctival ulcer**) cases ulcers developed from gray or grayish yellow pustules on

the conjunctiva during an acute conjunctivitis with severe symptoms of irritation. These ulcers, which were very often situated at the margin of the lid, were always superficial and never involved the sclera. Sometimes they were isolated, accompanied only by an acute conjunctivitis, sometimes they were associated with what looked like phlyctenules.

TEICHNER'S (62, **Ulcer of the conjunctiva involving the sclera**) case was that of a woman 52 years old who had a conjunctivitis marked by florid pointed elevations. A diagnostic injection of old tuberculin caused a severe general reaction and a local reaction in the lungs. In the conjunctiva, not far from the limbus, were eight small ulcers varying in size and depth. After these had healed traces of only the largest were visible, and one of these had involved the sclera deeply, leaving a sharply defined, punched out place about 1.5 mm in diameter. The Wassermann and bacteriological findings were negative.

HIWATARI (59, **Diagnosis of trachoma granules upon the limbus**) thinks that some of those who report trachoma granules at the limbus may have overlooked the fact that the cicatricial contraction of the conjunctiva sometimes brings the granulations near the cornea when they are primarily developed in the fornix. Also it is quite possible for a secondary infection to produce granulations resembling trachoma. In true trachoma the marginal portions of the granules, usually a narrow zone, consist of small lymphocytes while the wide interior parts, the germ center consist of large lymphoid cells.

ALLING.

The patients of both ALBERS-SCHÖNBERG AND FRANKE (56, 58, **Melanosarcoma of the corneal margin cured by X-rays**) were treated exclusively with the X-rays with good results, and no recurrence had appeared in either at the end of two years.

IX.—THE CORNEA AND SCLERA.

64. AXENFELD. **Embryotoxon coreæ posterius.** *Ophthalm. Gesellsch. Heidelberg*, August 5-7, 1920.
65. BOTTERI. **Contribution to the pathology of scleritis.** *Klinische Monatsbl. f. Augenheilkunde*, lxiv., p. 666.
66. CALHOUN, P. F. **Primary epibulbar carcinoma.** *American Journal of Ophthalmology*, February, 1921.

67. GRÜTER. Optochin, with special reference to *ulcus serpens*. *Zentralbl. f. d. ges. Ophthalm. u. ihre Grenzgebiete*, iii., 3, p. 81.
68. GRÜTER. Experimental and clinical studies of *herpes corneæ*. *Ophthalm. Gesellsch. Heidelberg*, August 5-7, 1920.
69. JABLONSKI. Congenital melanosis of the sclera. *Berl. Ophthalm. Ges.*, April 22, 1920.
70. JUNIUS. Observations and thoughts concerning rodent ulcer of the cornea. *Zeitschr. f. Augenheilk.*, xliii., p. 480.
71. KOEGEL. A rare syphilitic disease of the eye. *Med. Ges. in Jena*, January, 1920.
72. LÖWENSTEIN. Recent findings in the study of *herpes*. *Ophthalm. Ges. Heidelberg*, August 5-7, 1920.
73. POLLACK. Amyloid (hyaline) of the conjunctiva and cornea. *Berl. Ophthalm. Ges.*, April 22, 1920.
74. RUMBAUR. Large dermoid of the cornea and sclera. *Klin. Monatsbl. f. Augenheilkunde*, lxiv., p. 790.
75. STEIGER. Variability of the corneal astigmatism. *Zeitschrift f. Augenheilkunde*, xliii., p. 144.
76. UHTHOFF. Dystrophia corneæ epithelialis. *Ophthalm. Ges. Heidelberg*, August 5-7, 1920.

After investigation of a large amount of material STEIGER (75, **Variability of the corneal astigmatism**) considers it certain that the astigmatism of the human cornea undergoes greater or less change in half the eyes between the sixth and the twelfth year, and that this change is of practical importance in a large number of the cases. Increase of astigmatism during the time of observation was much less common than decrease. Originally unlike eyes develop independently. Only 1.5% of 397 eyes had full vision or better when first examined, but in five years and a half this had increased to somewhat over 50%.

The disease had lasted over ten years in UHTHOFF's (76, **Dystrophia corneæ epithelialis**) patient, affecting first the right eye and later the left, and presenting the clinical picture accurately described by Fuchs in 1910. In the right eye the disease finally resulted in an intense grayish white opacity of the entire cornea, with the exception of a narrow strip at the margin, with some vascularization. The surface was smooth, but the diseased area was slightly swollen. The superficial layers of a portion of the diseased area of the cornea were removed for examination. The epithelial layer was thickened, the superficial portion swollen in places. The upper epithelial cells were in places drawn out longitudinally, so that occasion-

ally they seemed to be parallel fibers. The lowest layer of the basal cells alone could be called practically normal, but even here some of the cells showed pathological changes. Bowman's membrane was entirely absent. The superficial layers of the corneal tissue were in places completely degenerated and transformed into a matted tissue of fine fibers with a sparse amount of degenerated cornea. In other places the corneal tissue was broken down into broad, wavy lines, and edematous. The changes affected the superficial layers of the cornea particularly, while the deeper ones seemed to be still transparent.

AXENFELD (64, *Embryotoxon corneæ posterius*) pictures the case of an otherwise normal young man in both of whose eyes there was a whitish ring about 1 mm from the margin of the cornea at the level of Descemet's membrane, to which ran a number of minute fibers from the anterior surface of the iris through the anterior chamber. Between this ring and the periphery was a very delicate cloud at the same level. There was no minor circle of the iris, and there was a partial coloboma of the anterior surface in the left; otherwise the irides were normal. This was a case of imperfect differentiation between the iris and the cornea.

The investigations of LÖWENSTEIN (72, *Recent findings in the study of herpes*) seem to show that the virus of febrile herpes has no special affinity for the corneal nerves. He is of the opinion that many forms of iritis in which the ætiology is obscure are of herpetic origin, and that the iritis of certain infectious diseases, which are associated with herpetic blebs, should be ascribed to the herpes virus.

GRÜTER (68, *Studies of herpes corneæ*) believes that there is a specific virus which induces a necrosis that gradually passes from the epithelium into the adjoining layers of the parenchyma. This virus is very sensitive to temperature, and must be carried immediately from cornea to cornea in inoculation experiments.

GRÜTER (67, *Optochin*) claims that optochin is a specific bactericide for pneumococci. The streptococcus viridans also is affected by optochin, but is decidedly more resistant. Addition of serum induces a precipitation of albumin in test tube experiments, and a moderate inhibition of the bacteri-

cide power of optochin. Pneumococci taken immediately from ulcers or the conjunctiva are a hundred times more resistant to optochin than laboratory stocks, yet the bactericide effect is not demonstrably influenced by a high degree of virulence of the pneumococci. A fresh solution must always be used, for a solution will not keep longer than fourteen days. Solutions under 1% in strength are inefficient for the treatment of *ulcus serpens* and the sterilization of the conjunctiva. Optochin hydrochlorate must not be combined with atropine sulphate, because such a combination will result in the precipitation of the insoluble optochin sulphate. For ulcers with deep infiltration a daily application of 5% optochin for five minutes is recommended; stronger solutions cauterize the cornea and conjunctiva. He warns against injections into the cornea or anterior chamber. The conjunctival sac can be cleared of pneumococci by the instillation once or twice a day of a one or two per cent solution of optochin for at least two days. In diseases of the lacrimal sac optochin is of only transient benefit. In *ulcus serpens* the result depends on the site of the pneumococcal focus. In superficial ulcers the remedy does good service, but the effect becomes less as the infiltration becomes deeper and more extensive. Prolonged use of optochin induces irritation with iritis and danger of secondary glaucoma. Faulty regeneration of epithelium with the possibility of reinfection has been observed after repeated use of optochin. The duration of treatment is not materially shortened, and this method does not surpass others in the treatment of ulcers with deep infiltration.

According to JUNIUS (70, **Rodent ulcer of the cornea**) the rodent ulcer is a primary disease of the cornea, not connected aetiologically with episcleritis. Its typical seat is near the margin, where it starts as an infiltrate in the cornea; a central starting point has been observed thus far in only a single case. There are abortive forms which run a benign course. The following points are indicative of a neuropathic basis for the disease: The reduction of the sensibility of the cornea, which is not always demonstrable; the interference with the tension of the eye likewise not always demonstrable; the involvement of the ciliary nerves in the pathological process, and its relations

to other forms of corneal disease of neuropathic origin, particularly herpes corneæ. Of the symptoms which generally accompany peripheral nerve lesions, oedema, formation of blebs, and necrosis, necrosis at least is a constant accompanying symptom of the corneal affection, and, as in other neuropathic corneal diseases, the advance of the disease is in many cases the first to be discontinued. The cause of the disease is to be sought in some cases in the peripheral trigeminus, in others in the ganglia and the central part of the trigeminus. The fact that the trouble is bilateral in more than a third of the cases goes to show that a central site is not uncommon. Bacteria probably take part in the development of the ulcer, but clinical experience indicates that there is no specific agent. Every agent can be found, for the resistance of the cornea to each is neurotrophically weakened. The rare observations of dystrophia marginalis corneæ in childhood indicate a special sensibility of the marginal portions of the cornea to any injury. If Junius's ideas concerning the nature of this disease are correct, cauterization should be excluded from the methods of treatment as inefficient and probably harmful.

KOEGEL'S (71, *A rare syphilitic disease of the eye*) patient had a yellowish infiltration of the cornea and secondary glaucoma in one eye, which was enucleated. After a short time the same disease attacked the other eye, with violent symptoms of inflammation. Syphilis was determined to be the cause, and recovery was prompt after treatment with salvarsan.

POLLACK (73, *Amyloid (hyaline) of the conjunctiva and cornea*) says that, although the microscopic picture was that of amyloid, the various tests for amyloid reactions gave a negative result, whether tried with fresh or hardened material. The tumor should perhaps be spoken of as one of hyalin which did not differ from amyloid morphologically, but did differ in its microchemical reaction.

CALHOUN (66, *Primary epibulbar carcinoma*) removed a tumor about the size of a hazel-nut which was attached to the sclera. As it proved on examination to be a carcinoma he made three applications of radium. One year later the patient returned with a small recurrence and an enlarged preauricular gland. Both were excised and after six years no return of the

tumor has taken place. He advocates conservative surgery when the tumor is remote from the limbus, even though large, and thinks that radium should be used. Involvement of the preauricular gland is not necessarily serious according to his present experience.

ALLING.

The tumor reported by RUMBAUR (74, **Large dermoid of the cornea and sclera**) was taken from the eye of a child 1 year old. It was congenital and had grown rapidly. It was 12mm high by 17mm broad at the base, projecting like a sac from the sclera and cornea. The peculiarity of the case was the excessive growth of the tumor, both intra- and extrauterine, and the size finally attained, which seems to the writer to have been unique. The development of the eyeball had not suffered from the growth of the tumor, so far as could be recognized from the few sections.

BOTTERI's (65, **Scleritis**) case is remarkable on account of the severity and extent of the infiltration, which reached far back of the equator, on account of the rare appearance of a large scleritic nodule near the optic nerve, and on account of the simultaneous infiltration of the orbital fat, which is unusual in scleritis.

JABLONSKI (69, **Congenital melanosis of the sclera**) designates as symptoms of melanosis oculi a dark, spotted or diffuse, discoloration of the sclera, a heavily pigmented iris with a uniformly felted or papillary surface, and a dark tone of the fundus, usually of only one eye. The peculiarities of the two cases reported by him were that in both the condition was bilateral, the sclerae were abnormally thin, the function was affected and in one case the more melanotic eye was the more myopic, and the trouble seemed to be familial, as the patients were sisters and the parents showed signs of abnormally great pigmentation.

X.—THE PUPILS.

77. BEHR. **The reaction of the pupil to the closure of the lids.** *Ophthalm. Gesellsch. Heidelberg*, August 5-7, 1920.
78. FRIEDENTHAL. **Monolateral perverse reaction to convergence.** *Berl. Ophthalm. Gesellschaft*, 1920.
79. GROENTHUYSEN. **The motor and optic sensitiveness to differences in diseases of the eye.** *Ophthalm. Gesellsch. Heidelberg*, Aug. 5-7, 1920.
80. OLOFF. **Hemianopic pupillary reaction.** *Ibid.*, August 5-7, 1920.

While the reaction of the pupil to closure of the lids is present in all normal persons, it is usually difficult to demonstrate. The cause of this difficulty is to be found, according to BEHR (77, **Reaction of the pupil to the closure of the lids**), in an inhibition through the sphincter tone dependent on the light reflex. It is much more distinct in amaurotic pupillary immobility, when it may approach very nearly a normal reaction to light or convergence. If the amaurotic immobility passes away, this reaction again becomes indistinct. As a rule it is very distinct in reflex immobility in consequence of the abolition of the inhibition through the light reflex. In absolute immobility it is absent in a third of the cases, is pathologically involved in a second third, and is prompt in the remaining third. In ophthalmoplegia interna it is absent in perhaps a fifth of the cases, imperfect in rather more than half, and normal in about a half. In central oculomotor paralysis it is lost together with the other pupillary reactions in the great majority of cases, but may be either impaired or normal even when the pupils are immobile to light and convergence. In peripheral oculomotor paralysis this reaction as a rule parallels the reaction to convergence; if one is lost so is the other, if one is preserved, the other exists to a like degree, although there are exceptional deviations from this rule. The preservation of the reaction to closure of the lids in central pupillary paralyses suggests the possibility that the lesion spares the nucleus of the sphincter and is localized in the region of the extra or supranuclear conducting tracts. This would explain how it is that the Edinger-Westphal nucleus is spared in the general nucleus degeneration of central oculomotor paralysis in spite of the clinically established immobility of the pupils.

FRIEDENTHAL'S (78, **Monolateral perverse reaction to convergence**) patient had bilateral immobility to light. The right pupil was the larger and contracted in convergence, while the left was smaller and dilated in convergence. The patellar reflexes were weakened, the Wassermann positive.

GROENTHUYSEN (79, **The motor and optic sensitiveness to differences**) gives the results obtained thus far in the study of the pupillary movements with the aid of Hess's pupilloscope. He first established the fact that in normal cases the most minute differences of light strength which can be recognized

as different by the examined eye suffice to induce a contraction of the pupil by the stronger. The optic sensibility to difference is therefore equal to the motor sensibility to difference. Differences of light strength in the ratio of 95:100 suffice to excite both. By means of this method disturbances in the play of the pupils can not only be recognized earlier than was hitherto possible, but the degree of disturbance can also be expressed in figures. The consensual motor sensibility to difference is the same as the direct. In diseases of the reflex arc not only are greater differences of light strength necessary, but the values of the individual sensibilities to difference frequently decline in so characteristic a manner as to furnish a valuable diagnostic help in the localization of the lesions. For example, in optic atrophy the motor and optic sensibilities always are reduced the same amount, while in a chronic retrobulbar neuritis the motor is usually reduced to a greater degree than the optic. In the so-called reflex sluggishness the motor is reduced to a degree corresponding to the trouble, while the optic always remains normal.

OLOFF (80, *Hemianopic pupillary reaction*) reports a case of shot-wound of the brain, which induced symptoms referable to the eye alone in the form of a left-sided homonymous hemianopsia with immobility to light when the right halves of the retinae were irradiated. Irradiation of the left halves of the retinae caused the pupils to react promptly. The probable diagnosis was that of a lesion in the right tract, and the roentgenograph showed the presence of the projectile in the region of the right optic tract.

XI.—THE UVEAL TRACT AND SYMPATHETIC OPHTHALMIA.

81. AXENFELD. Movable inflammatory pupillary membrane. *Zeitschrift f. Augenheilkunde*, xliii., 1920.
82. CLAPP, C. A. Significance of syphilis as an ætiological factor in acute iritis. *American Journal of Ophthalmology*, March, 1921.
83. DANIS, M. Proliferating choroiditis. *Ibid.*, March, 1921.
84. HEITMANN. A noteworthy tumor of the ciliary body. *Klin. Monatsbl. f. Augenheilkunde*, lxiv., 1920.
85. HERRENSCHWAND. Clinical contribution to the coincidence of a tuberculous and a syphilitic infection in the same eye. *Ibid.*
86. JESS. A case of sympathetic ophthalmia. *Deutsche med. Wochenschr.*, 1920, p. 616.

87. KADLETZ. Sarcoma of the choroid without detachment of the retina. *Ophthalmic Society of Vienna*, March 15, 1920.
88. KADLETZ. Deposit of lime in the ciliary processes. *Ibid.*
89. VON SZILY, A. Melanoma of the choroid. *Ophthalm. Gesellsch. Heidelberg*, August 6-7, 1920.
90. WETZEL. Sympathetic ophthalmia and disturbances of hearing. *Monatschr. f. Unfallheilk u. Invalidwesen*, xxvii., No. 4.

AXENFELD's (81, **Movable inflammatory pupillary membrane**) case, met with in an otherwise sound man 25 years old, was evidently not a membrana pupillaris perseverans, but rather was of inflammatory origin, though it probably started very early, perhaps during embryonal life. In the small pupil a folded, grayish white membrane, which impaired the vision considerably, was visible. When the pupil was dilated the membrane became smooth and transparent, so that the vision was improved, and the fundus became visible as through a thin veil. With the binocular loupe it could be seen that the membrane had nothing to do with the anterior layer of the iris, yet was connected with the posterior layer in several places by a sort of posterior synechiæ. A connection with the lens was not demonstrable, and therefore the membrane was movable. The writer thinks that adhesions to the lens had formerly existed, but had broken loose. He felt no doubt as to the inflammatory character of the condition.

CLAPP (82, **Significance of syphilis as an ætiological factor in acute iritis**) reports the results of his experience in reference to syphilis as the cause in one hundred cases of acute iritis and found 80% due to this disease. It is to be noted that 68 of the cases belonged to the colored race and also that the diagnosis in some cases was made from the fact that the case made a speedy recovery under antisiphilitic treatment. ALLING.

HERRENSCHWAND (85, **Tuberculous and syphilitic infection in the same eye**) reports a case in which an iritis in a woman 42 years old was positively diagnosed as tubercular, healed under specific treatment, recurred once, and finally got entirely well. Seven weeks later there appeared in the same place a typical syphilitic papule, which disappeared under specific treatment. A fresh syphilitic infection had been acquired. The interesting point in the observation is that the site of the formerly tuberculous place formed a locus minoris resistentiæ.

Tuberculosis and syphilis frequently occur simultaneously in the eye, but syphilis commonly precedes the tuberculosis.

HEITMANN (84, **Tumor of the ciliary body**) describes a case in which the eye of a girl 13 years old was enucleated on account of what had been diagnosed as a pigment sarcoma. The histological examination showed the tumor to be one difficult to classify in the known groups. Microscopically it resembled a gumma or a sarcoma. Tuberculosis was excluded. Although it was probably a melanosarcoma, and the enucleation was justified, the case suggests the advisability of a short course of treatment with iodides being tried before enucleation is resorted to.

KADLETZ (88, **Deposit of lime in the ciliary processes**) exhibited specimens of five eyes with deposits of lime in the ciliary processes. The causes of enucleation were panophthalmitis, atrophy after cataract extraction, necrotic sarcoma, sarcoma of the choroid without changes in the anterior portion of the eye, and an epibulbar sarcoma likewise without changes in the rest of the eye. The ciliary processes had undergone hyaline degeneration in places, and here the lime was found in larger masses, some sharply defined, others reaching over the entire breadth of the processes. As two of these eyes were without other changes here, it is probable that these changes were of age.

DANIS (83, **Proliferating choroiditis**) found a club-shaped gray white mass covering the optic nerve and protruding into the vitreous. The posterior pole of the eye was slightly excavated and there was a circle of peripapillary choroiditis with abundant pigmentation. The lesion was the result of a severe contusion. Lagrange has described proliferating choroiditis which differs from the simple proliferating retinitis in that it presents a more regular and localized mass instead of a weblike character. The mass is opaque and of even surface. The usual location is at the macular or the nerve. It is accompanied by pigmentation and does not produce retinal detachment.

ALLING.

KADLETZ (87, **Sarcoma of the choroid without detachment of the retina**) reports a case in which the retina was split by the growth instead of being detached. The tumor was 8.9mm broad at its base, 4.31mm high. It was a leucosarcoma with-

out necrosis. The retina was split into two layers, so that only the cerebral layer covered the growth. The outer neuron and the optic nerve were slightly atrophic.

The case reported by von SZILY (89, **Melanoma of the choroid**) is said to be the first to be studied both clinically and pathologically. The six cases already reported were found as such in pathological preparations. The clinical picture in the fundus differs from that of the beginning sarcoma and rather resembles the so-called grouped nævoid pigmentation. The histological picture is that of proliferation and enlargement of the chromatophores with marked accumulations of pigment, particularly in the outer and middle layers of the choroid, the choriocapillaris and pigment epithelium being spared. Melanoma of the choroid seems to be a benign proliferation of cells.

JESS (86, **A case of sympathetic ophthalmia**) reports the case of a battle wound which led to sympathetic ophthalmia. The patient refused to allow the wounded eye to be removed. At the end of four weeks sympathetic ophthalmia was present, starting with a neuroretinitis, and developing a severe plastic iridocyclitis which was under treatment for a year and a half. The traces left by the iridocyclitis can still be seen. The vitreous is clear, while the fundus shows small spots of choroiditis. Normal color sense is present in only a temporal crescent of the retina, elsewhere there is total blue-yellow blindness. There is also a high degree of disturbance of adaptation.

WETZEL'S (90, **Sympathetic ophthalmia and deafness**) case was one of penetrating wound of the eye which excited sympathetic ophthalmia in about five weeks. The wounded eye was removed, but not examined. From the time of his entrance into the hospital the man was deaf, and his deafness was believed to have been caused by the sympathetic ophthalmia. The explanation presented to account for the involvement of the labyrinth is that the pigment here acts as an antigen to induce an anaphylactic phenomenon just as it does in the unwounded eye in sympathetic ophthalmia.

XII.—THE LENS.

91. BECKER. **Bilateral total cataract and secondary glaucoma after a severe electric shock.** *Heidelberg Ophthalm. Gesellsch.*, August 5-7, 1920.

92. RUMBAUR. Another remarkable case of copper cataract. *Klin. Monatsbl. f. Augenheilkunde*, lxiv., 1920.

BECKER'S (91, **Bilateral cataract and secondary glaucoma after a severe electric shock**) patient came into contact with an electric current of 60,000 volts, received burns of the first, second, and third degrees on various parts of his body, and shortly afterward opacities were observed in both lenses. These developed within three and a half months into total cataract, with severe glaucomatous pain caused by the swelling of the lenses. An iridectomy was performed on each eye to relieve the pain, and later the cataracts were removed. Correcting glasses gave the patient perfect vision for distance and near.

RUMBAUR'S (92, **Another remarkable case of copper cataract**) patient had been wounded in the face and right eye five years before. The eye had suffered penetrating wounds, but no intraocular foreign body could be found at the time. The most marked symptom five years later was a central opacity of both the anterior and posterior capsule of the lens. Both were iridescent, the posterior the more so. By focal illumination with the corneal microscope and the Nernst slit lamp a relief-like shagreening became visible with deeply saturated metallic colors, red, blue-green, yellow, and transition colors. In transmitted light only fine, colorless shadows could be seen, coming from the posterior opacity. With the ophthalmoscope extensive contusion changes could be seen in the choroid and retina, pigment spots in the macula, and preretinal cords. The roentgenograph revealed several minute foreign bodies in the orbit, of which only one could possibly be in the eyeball. The condition of the lens was considered characteristic of the specific chemical action of an intraocular foreign body composed of or containing copper, and this diagnosis was made although no foreign body was distinctly demonstrable.

XIII.—GLAUCOMA.

93. AXENFELD. High myopia and glaucoma. *Ophthalm. Gesellsch. Heidelberg*, August 5-7, 1920.

94. BRANDT. Experiences with Elliot's trephining. *Ibid.*

95. CREMER. Experiences with cyclodialysis. *Klin. Monatsbl. f. Augenheilkunde*, lxiv., p. 802.

96. HAMBURGER, C. **The mechanics of glaucoma and of its operations.** *Ophthalm. Gesellsch. Heidelberg*, August 5-7, 1920.
97. HERTEL. **Studies of the blood and aqueous in glaucoma.** *Ibid.*
98. KÖLLNER. **Observation concerning the pressure reducing action of miotics in simple glaucoma.** *Zeitsch. f. Augenheilkunde*, xliii., p. 421.
99. KÖLLNER. **Demonstration of curves showing the influence of the size of the pupil upon the tension in simple glaucoma.** *Ophthalm. Gesellsch. Heidelberg*, August 5-7, 1920.
100. KOEPPE, L. **The stereomicroscopic picture of the living angle of the anterior chamber in glaucoma with Gullstrand's Nernst slit lamp.** *Ibid.*
101. SHAHAN, W. E., and POST, L. **Thermophore studies in glaucoma.** *American Journal of Ophthalmology*, February, 1921.

HAMBURGER (96, **Mechanics of glaucoma and of its operations**) points out that a local increase of pressure accompanies all inflammations in the body, with the single exception of the eye, in which the typical intraocular inflammation induces a softening instead of a hardening of the globe. This must be due to the presence of many outlets. Primary inflammatory glaucoma is based on quite different mechanics, for in this the eye is hard, just as in inflammation elsewhere in the body. The mechanical explanation of cures wrought by iridectomy and trephining is untenable, for cicatrices are not more, but less permeable than physiological tissue. Therefore it may be better to give up all claim to a mechanical explanation, just as general surgeons do in the curing of abdominal tuberculosis by incision. At best one may consider that in the operative treatment of glaucoma an influence is exerted upon the nerves in a way similar to that in which many angioneuroses are benefitted by nerve stretching. It is possible that this inflammation of the eye is of psychogenous origin, a neurosis.

According to AXENFELD (93, **High myopia and glaucoma**) the diagnosis of glaucoma is not made in many cases of high myopia for the following reasons: 1. The loss of vision may seem to be perfectly explainable, in a brief examination, by the well known myopic changes about the papilla and especially in the macula, unless the periphery of the visual field is studied and defects found here, which are not satisfactorily explained by the changes in the myopic fundus, an investigation not made by many in high myopia. The interpretation of peripheral contractions is also difficult, as high myopia can induce certain contractions by itself. But extensive defects, especi-

ally on the nasal side, arouse suspicion of glaucoma. Axenfeld believes that even in extreme myopia, when the optic nerve is not particularly involved, there are no great peripheral contractions and disturbances of orientation. 2. The ophthalmoscopic picture of the papilla in high myopia with glaucoma simplex need not present the typical picture of glaucomatous excavation. This is not distinctly formed in the majority of cases in which there are marked changes due to stretching. It may be very serious for the patient when one feels inclined to suspect glaucoma only in the presence of a marked excavation. Even in advanced cases the papilla may be only pale, yet it may be difficult or impossible to diagnosticate commencing atrophy, because the temporal side of the disk may be just as pale in high myopia. 3. The increase of tension of a simple glaucoma in a highly myopic eye is slight and may be within physiological limits. The writer has not seen much increase of tension in cases of this nature. For the diagnosis one must rely more than heretofore upon the margins of the peripheral visual fields, especially when the disturbances of vision are serious and increasing. Tonometry should be used more in high myopia, and when the condition of the visual field is suspicious the effect of miotics should be controlled by the tonometer. A marked lowering of the tension by pilocarpine will at least contribute toward the diagnosis, naturally taking into account the physiological fluctuations and the fact that miotics can lower the tension even in normal eyes. Particularly important are the natural differences of tension between the two eyes. With regard to operative measures, cycloidalysis is best suited to the very myopic eye, as it does not empty the anterior chamber and cause a sudden loss of tension.

KOEPPE (100, *The stereoscopic picture of the living angle of the anterior chamber in glaucoma*) describes the appearance of the surface of the ciliary body at the base of the angle, the course of the uveal framework of the ligamentum pectinatum, the ciliary margin of the iris, and the ciliary processes bridging over the angle, as seen by him with the aid of a special instrument which magnified the images forty times. The latter are pigmented in varying density, arise from the ciliary margin of the iris, and are inserted into the scleral framework of the inner surface of the root of the cornea. The entire net-

work covering the surface of the ciliary body shows lucunæ and resembles the surface of the iris, but it may also be very sparse. Retinal pigment occurs sporadically in the framework, or on the adjoining root of the iris, varying in size and distribution, and likewise on the inner surface of the root of the cornea. Occasionally Schlemm's canal could be made out as a dark zone. Isolated vascular twigs and loops were visible, together with a marked circular and meridional structure of the inner surface of the root of the cornea. In old age there appears a beginning atrophy of the uveal trabeculae of the ligamentum pectinatum, as well as of the adjoining root of the iris and ciliary processes. Sometimes rather irregularly distributed dark pigment or dark lumps of pigment are to be seen, both referable to the wearing away and dispersion of the retinal pigment edge of the pupil toward the cornea and the angle of the anterior chamber. In persons predisposed to glaucoma, who have shown no clinical signs of this disease, there is a distinct displacement of pigment in the iris, and one may observe this, or other slight signs of age of the tissues, as well as a narrowing of the space of the angle by an approximation of the most peripheral zones of the iris to the inner surface of the root of the cornea so as to diminish the size of the visible portion of the surface of the ciliary body. In clinically manifest glaucoma these signs were especially marked, though the examination was rendered difficult or impossible in the inflammatory and secondary forms by the deposits of pigment and the cloudiness of the aqueous. One finds a more or less distinct stromal atrophy, and occasionally rather more strongly marked dark deposits of pigment in the framework of the surface of the ciliary body. Yet the chief factor in these cases was the covering of the surface of the ciliary body, or, in far advanced cases, of the corresponding portions of the inner surface of the root of the cornea by the most peripheral zone of the iris. In simple glaucoma Koeppe always found a smooth involution of the root of the iris to the cornea and no distinct signs of adhesion. The picture resembled that of the normal angle during mydriasis. He thinks that simple glaucoma is a symptom of a progressive encroachment of the root of the iris upon the corresponding part of the inner surface of the root of the cornea.

KÖLLNER (99, **Influence of the size of the pupil upon tension in simple glaucoma**) kept four patients with simple glaucoma alternately a day in a dark room and a day in the bright sun, but could detect no noticeable influence on the tension by the great changes in the size of the pupils. Artificial dilatation with homotropine, atropine, and scopolamine in eleven other cases caused no increase of tension, even though the mydriasis was continued for days. Only in one case, in which there was a particularly high degree of pigmentation of the iris and in the angle of the anterior chamber, there appeared in the course of five hours each time an increase of tension from 26 to 36. In pure glaucoma simplex, when the anterior chamber is not shallow, it would appear that a folding and unfolding of the iris is without noticeable influence on the tension in the majority of cases, or on the escape of fluid from the eye. If this is true, the action of miotics does not depend primarily on the unfolding of the iris.

KÖLLNER (98, **Pressure reducing action of miotics in simple glaucoma**) showed by curves that the contraction of the pupil may precede the fall of tension by as much as two hours. The time may be less, or even absent, in others. Otherwise the effect upon the pupil and the tension is uniform, and lasts one, two, or three days before it disappears completely. The effect of pilocarpine is of shorter duration than that of eserine. Both curves, those showing the contraction of the pupil and the tension show a sharp drop and a slow rise. Occasionally there are exceptions, in which the fall of tension may disappear first, or, rarely, last longer than the contraction of the pupil. Sometimes it happens that the pupil contracts well, but there is no fall of tension. That the influence of miotics is essentially upon the internal muscles of the eye, rather than through a possible contraction of the blood vessels is shown by an experiment in which eserine was instilled into one eye, and adrenalin injected beneath the conjunctiva of the other in the same patient. The tension of the first eye fell sharply, that of the second fell, but not to the same degree. If homatropine followed by eserine is instilled, the effect of the latter is slighter than it should be, or is wholly prevented, another evidence that it is not the vessel contracting power of eserine which is the essential feature of its action, although it may be of assist-

ance. It is more likely that a better outflow is made possible by an unfolding of the iris, just as through the unfolding of the ligamentum pectinatum by the ciliary muscle.

BRANDT (94, *Trephining*) reports 643 operations for glaucoma, including 375 trephinings according to Elliot's method. In glaucoma simplex trephining is unquestionably superior to iridectomy. The glaucoma had been brought to a standstill in 78.8% of 66 trephined eyes which had been under observation at least a year, and an average of three years. In inflammatory glaucoma iridectomy is preferable, as it suffices in the majority of cases without the danger of late infection. In glaucomatous iritis and secondary glaucoma due to luxation or subluxation of the lens, trephining is the more promising, while in secondary glaucoma caused by exclusion of the pupil iridectomy alone should be considered. In the buphthalmos of children the superiority of trephining over multiple sclerotomies could not be established. Eight late infections occurred, resulting in five in blindness or loss of the eye. Other complications are of less importance.

CREMER (95, *Cyclodialysis*) has performed cyclodialysis on eleven eyes, on part of them over six years ago. The results were exceptionally good. In one case the operation had to be repeated at the end of two years. It should be performed as early as possible.

HERTEL (97, *Studies of the blood and aqueous*) has measured the osmotic concentration of the blood by the haemolytic method in a large number of cases of glaucoma. The figures found were often so much lower than that of eyes which were normal or suffering from other disease as to seem to justify the assumption that the transport of salt and water is disturbed in glaucomatous eyes. He calls attention to the influence of the internal secretions, especially of the thyroid, upon these processes, on the basis of clinical observations. He found nothing to support the theory of disturbances through colloids caused by an abnormal formation of acid. In glaucoma, as compared with diseased eyes without increase of tension, there was neither a diminution of the carbonic acid tension in the blood, nor unequivocal differences in the hydrogen in concentration of the aqueous.

SHAIHAN and POST (101, *Thermophore studies in glaucoma*)

have been experimenting with rabbits and proved that the intraocular tension may be reduced by application of the thermophore. They have also treated a number of cases of glaucoma. The cases which had a swollen lens and shallow anterior chamber were not benefited but the cases of simple glaucoma showed a falling of the tension within 48 hours and it remained low for a number of months. Then came a return of the tension which responded readily to the application of heat. Further experience is necessary to establish the value of the method.

ALLING.

XIV.—THE RETINA AND VITREOUS.

102. AXENFELD. Periphlebitis retinæ tuberculosa. *Ophthalm. Gesellschaft Heidelberg*, August 5-7, 1920.
103. BACH. Gramnegative micrococci in a panophthalmitis. *Zentralbl f. Bacteriologie*, lxxxiv, p. 214.
104. CRIST, W. H. Spasm of the retinal arteries. *American Journal of Ophthalmology*, March, 1921.
105. ISCHREYT. Circulatory disturbances of the eye. *Zeitsch. f. Augenheilkunde*, lxiii, p. 421.
106. ISCHREYT. Metastases. *Ibid.*, p. 428.
107. KRÜCKMANN. Retinitis septica. *Virchow's Archives*, ccxxvii., No. 2.
108. QUIST. A case of pigment stripes of the retina. *Klinische Monatsbl. f. Augenheilkunde*, April, 1920, p. 565.
109. SIEGRIST. The nose and the eye. *Ophthalm. Ges. Heidelberg*, August 5-7, 1920.
110. SIEGRIST. Glioma retinæ. *Ibid.*
111. VERHOEFF, W. F. Microscopic findings in a case of asteroid hyalitis. *American Journal of Ophthalmology*, March, 1921.

QUIST (108, **Pigment stripes in the retina**) reports a case of angioid streaks in the retina. The right macula was slightly gray, with hemorrhages at the margin and some white spots to the temporal side and below. Toward the periphery were a number of brown stripes running in the direction of the choroidal vessels, and consisting of crowded brown points. The condition in the left eye was the same except that the hemorrhages were fewer.

KRÜCKMANN (107, **Retinitis septica**) has examined the retinae of four cases pathologically. The white foci of degeneration were in the ganglion cells and the inner nerve fibers. The hemorrhages lay in all the layers of the retina. Infiltra-

tions of leucocytes, marginal arrangements of leucocytes, and oedema were absent. The pathological examination of the kidneys revealed similar pictures.

ISCHREYT (105, *Circulatory disturbances*) has seen six cases of embolism of the central artery. Two of these patients died of apoplexy. One case was bilateral and appeared sixteen days after a gastroenterostomy. Although at the time the eyes became affected there was a marked murmur with the first sound of the heart, Ischreyt does not believe an endocarditis to have been the cause, because the presence of heart disease was excluded before the operation. He is inclined to think that particles from the operation wound entered the greater circulation. Blindness came on in the course of a few hours, so the possibility of a thrombosis was not excluded.

Cases of spasm of the retinal arteries are well known and though usually of short duration, may be sufficiently protracted to produce permanent blindness in the areas supplied by the vessels affected. CRISP (104, *Spasm of the retinal arteries*) relates the case of a normal girl of 14 who became blind in the lower nasal field after an exciting automobile ride. He found the upper temporal artery interrupted a short distance from the disk by a white band of equal width with the vessel which was filled with blood on either side. The field was still defective when the case was observed eleven weeks later. He considers the condition one of spasm although the vessel walls are supposed to be transparent and invisible when not filled with blood.

ALLING.

AXENFELD (102, *Periphlebitis retinæ tuberculosa*) has found true tubercles in the walls of the veins in a periphlebitis retinæ tuberculosa, which was described by him and Stock in 1909 as the most frequent cause of juvenile recurrent intra-ocular hemorrhages. In many places they are situated indolently in the adventitia without obstruction of the lumen, while in other places they attack the inner layers of the true wall of the vein. This results in an extremely different course in the different places. The arteries were perfectly free. As such nodules may disappear in a few weeks, leaving no traces, they may be classed with tuberculids, or at any rate they must be held to be a true localization of bacilli. The exclusive distribution in the veins shows a noteworthy and interesting

type, which appears to be peculiar to the pathology of the brain, to which the retina belongs.

SIEGRIST (109, **The nose and the eye**) reports four cases of various kinds of disease of the retina and its vessels in which no cause could be found, aside from a coincident inflammation of the accessory sinuses, by a thorough general examination. Treatment of the accessory sinuses was followed immediately by recovery from the retinal troubles. Siegrist is therefore of the opinion that affections of the accessory sinuses can sometimes cause diseases of the retinal vessels. He also describes a case of monolateral choroiditis disseminata in a young girl, in whom an ethmoiditis on the same side appeared to be the only cause, but the opening of these cells led to a lesion in their root and the death of the patient from purulent meningitis.

SIEGRIST (110, **Glioma retinae**) showed a sketch of a peculiar quiescent glioma, which had been exhibited by himself in 1912 and by Axenfeld in 1918. At the present time, ten years after its first appearance, the tumor remains of about the same size in the region of the macula. Central vision still remains 1.0. He also showed the ophthalmoscopic picture of a commencing glioma in the other eye, which starts from the papilla. The two pictures do not resemble each other.

BACH (103, **Gramnegative micrococci in a panophthalmitis**) reports a case in which panophthalmitis followed an operative intervention for detachment of the retina. The characteristics of the micrococci cultivated from the pus did not agree with those of the known stocks. On the slide they resembled gonococci, but were not uniform in size or shape. A luxuriant growth with mucous character was obtained on grape sugar ascites agar. Grayish white colonies grew on this as well as agar, and glycerine agar. Luxuriant growth without liquification on gelatine. In bouillon uniform cloudiness with no formation of indol. Growth only on the surface, with no formation of gas or acid, of grape sugar. The method of infection is not certain.

ISCHREYT (106, **Metastases**) reports the case of a man 28 years old, healthy except for epilepsy, who lost his eye within a few days from panophthalmitis. Another patient had dense vitreous opacities while suffering from uræmia.

Asteroid hyalitis is distinguished from synchysis scintillans

by the shape of the opacities and absence of glistening reflexes.

VERHOEFF (111, **Microscopic findings in a case of asteroid hyalitis**) reports the microscopic and microchemic examination of a case of this sort which occurred in an eye enucleated for hemorrhagic glaucoma. He found the vitreous filled with small, nearly spherical bodies which appeared dark brown by transmitted light, a brilliant white by reflected light. They tended to form groups. They failed to stain with the ordinary reagents but took hematoxylin irregularly. No solvent seems to have been found but they emitted bubbles of gas when treated with acids which would indicate that they contained calcium carbonate. There was also a reaction for fat.

ALLING.

XV.—THE OPTIC NERVE AND TRACT.

112. BEHR. Origin of choked disk. *Arch. f. Ophthalm.*, ci., Nos. 2 and 3.
113. FUCHS, A. The cerebrospinal fluid and changes in the optic nerve in syphilis. *Ophthal. Gesellsch. Heidelberg*, August 5-7, 1920.
114. FUCHS, E. Senile changes of the optic nerve. *Ibid.*
115. GOERLITZ. Histological examination of a case of blindness after great loss of blood. *Klin. Monatsbl. f. Augenheilk.*, June, 1920.
116. HANSEN. *Aëtiology and diagnosis of acute bilateral blindness.* *Munch. med. Wochenschrift*, 1920, No. 21.

FUCHS (114, **Senile changes of the optic nerve**) examined the optic tract, the chiasm, and the optic nerves taken from the cadavers of six persons between 70 and 82 years of age. Corpora amylacea were found in the intracranial portion of the optic tract in all cases, in some more than in others and in one 1500 in a section. At the entrance of the nerve into the optic canal the number of corpora amylacea diminishes abruptly, and only a few scattered ones could be found up to 15mm in front of the canal. In other cases the corpora amylacea disappear completely at the entrance of the nerve into the canal. The distribution of the corpora amylacea is perhaps determined by the lymph circulation, which is probably more rapid in the extracranial portion of the optic nerve than in the intracranial, so that more opportunity is afforded in the latter for the deposit of insoluble albumenoids, which the corpora

amylacea are supposed to be. When they are very numerous it may be that they impair vision through injury to the nerve fibers. In all the cases examined atrophic spots were found in the optic nerves, marked by diminution of the nerve bundles, sometimes almost to extinction, lessening of the stain of the medullary sheaths, and thickening of the septa. There was no inflammatory exudation. Most of the foci lie on the periphery of the nerves, but may penetrate and occupy up to a third of the section. They extend from the place of greatest atrophy three to five times as far upwards, toward the brain, as downwards. Few of the foci are as long as 20mm. The place where the foci are most marked, therefore the probable starting point, is most often in the canicular portion of the nerve. Circulatory disturbances in the little vessels, which enter the nerve from the pial sheath and the septa, are looked upon as the probable causes. In all of the cases sclerotic changes were present in the ophthalmic artery and the central artery of the optic nerve. The peripheral situation of most of the foci must cause a contraction of the corresponding place of the visual field.

GOERLITZ (115, *Histological examination of a case of blindness after great loss of blood*) found a marked oedema of the papilla in the layer of nerve fibers without signs of inflammation. Within the layer of nerve fibers were peculiar nodules projecting above its surface and sometimes ending in a point. These were collections of polymorphous, partly nucleated cells. In the optic nerves were circumscribed foci of degeneration, close to and behind the lamina cribrosa, within which the medullary sheaths were destroyed. The fatty degeneration in the optic nerve and retina reported by Ziegler could not be demonstrated, as the globe had not been properly treated for this purpose.

BEHR (112, *Origin of choked disk*) finds the parenchymatous oedema in the glial portion and nerve fibers present in the intraorbital and intracanalicular parts of the optic nerve, but not in the intracranial. The difference between the conditions of the intracranial and intracanalicular portion of the trunk of the optic nerve is often very distinctly marked. The atrophy of the nerve begins peripherally, the papillomacular bundle remains unaffected. Hence the cause of the atrophy

is not distal, but intracranial. In one case of florid choked disk a circumscribed atrophy was found which corresponded to the exit of the ophthalmic from the carotid. The frequently found adhesions speak against the transport theory. Increase of pressure within the skull causes a stagnation within the sheath. The cell proliferation ceases with the entrance of the optic nerve into the skull. The ampulla-like dilatation may be met with in normal nerves, but not to so high a degree as in choked disk. Its presence in the latter is rather a sign of long duration; it may be absent in fresh cases.

HANSEN (116, *Aëtiology and diagnosis of acute bilateral blindness*) emphasizes the value of the pupillary reactions in determining the site of the lesion. Their absence denotes that the lesion is below the primary optic ganglia, their presence that it is above. In nephritis and in lead poisoning there may be both peripheral and central causes, the former visible with the ophthalmoscope. Nothing is certain concerning the nature of the central amaurosis, whether it is toxic or caused mechanically by hydramia or anaemia of the brain. As the central amaurosis may be mistaken for a bilateral hemianopsia, the persistence of a hemianopsia after an attack is understandable. Hysterical amaurosis cannot be an affection of the occipital cortex, as it leaves no hemianopic defect. Also the parts which transform sensory impressions cannot be affected, as there remains no disturbance of optic memory. Tumors may impair the vision of both eyes when they are situated in the region of the chiasm, or when so situated in the occipital lobe as to compress both visual centers. When in blindness following meningitis the pupillary reactions and the fundus are intact, it must be assumed that the exudate is in the region of the calcarine fissure. Basal meningitis creates ophthalmoscopic and pupillary symptoms, yet the former may be absent. Each visual center may be affected by vascular diseases, such as embolism and thrombosis. Ruptured aneurysms and hemorrhages during whooping cough may destroy vision. Blindness may also be caused by infections and intoxications, such as methyl alcohol and optochin, and also by wounds of the skull.

A. FUCHS (113, *The cerebrospinal fluid and changes in the optic nerve in syphilis*) examined 84 syphilitics with positive

cerebrospinal fluid and found the optic nerves involved in 13. Six out of 46 patients who had been syphilitic longer than two years had papillitis with normal vision. He believes that no essential difference exists between a papillitis with normal vision and field, and one in which there are slight defects in the field, as all manner of transitions were found. A small central scotoma may exist at first and pass away, leaving the vision normal. In two cases of fresh syphilis he found an optic neuritis and negative cerebrospinal fluid. He gives the histological findings in the retrobulbar part of the optic nerve taken from a patient who had had a meningeal papillitis of both eyes, recovered from this so that the fundus presented a normal appearance, and died from acute yellow atrophy of the liver, following administration of salvarsan. The sheaths of the optic nerve, the vessels, and the connective tissue septa were normal, but in the marginal bundles of the nerve there was a considerable increase of glia in places and a moderate number of lymphocytes.

XVI.—ACCIDENTS AND FOREIGN BODIES.

117. LAUBER. **A case of extensive avulsion of the iris.** *Zentralbl. f. prakt. Augenheilkunde*, November-December, 1920, p. 197.
118. OLLENDORF. **Splinter of iron extracted from the iris 30 years after the injury.** *Zeitschr. f. Augenheilk.*, xliii., p. 571.
119. WEIGANDT. **Vegetable foreign bodies in the conjunctiva.** *Zentralbl. f. prakt. Augenheilk.*, November-December, 1920, p. 202.

In two months of observation of a case in which a large extent of the iris had been torn away from its root by a blow from the tail of a horse, LAUBER (117, **Extensive avulsion of the iris**) noticed that there was a total absence of inflammation, and of any signs of atrophy in the detached portion of the iris. The iris was detached from the ciliary body throughout three-fourths of its extent, and was connected with it only in its lower outer portion. A perforating wound of the globe was positively excluded. The lens was clear, and lay in its normal place without trembling. The ciliary injection disappeared in a few days after the injury, no signs of inflammation appeared, and the final vision was good.

Praun exhibited a patient in 1898 to prove that a piece of iron can remain in the eye for a long time, then nine years,

without causing any trouble. At the end of thirty years a severe iritis set in, with a slight local siderosis in the iris and lens. OLLENDORF (118, **Splinter of iron extracted from the iris 30 years after the injury**) extracted the piece of iron with a Hirschberg magnet, and recovery followed in a few days, leaving the eye with one fifth normal vision.

WEIGANDT (119, **Vegetable foreign bodies in the conjunctiva**) reports two cases of this nature. In the first a spine of a burr that had been thrown against the eye was found embedded in a mass of granulations in the upper lid, where it had acted as the cause of an extensive erosion of the epithelium of the cornea and a slight iritis. In the second case a conjunctivitis had existed for half a year, with much swelling of the upper lid and the formation of polyps. The exciting cause was found to be a yellow, threadlike structure lying amidst these granulations, which proved to be a coiled up blade of grass 8cm long.

ARCHIVES OF OPHTHALMOLOGY.

THE USE OF LIVING SUTURES IN THE TREATMENT OF PTOSIS.¹

BY DR. W. W. WRIGHT, TORONTO, CANADA.

(*With three illustrations on Text-Plate VII.*)

HAVING followed with considerable interest the experimental and clinical studies of Drs. W. E. Gallie and A. B. Le Mesurier in the use of living sutures and having discussed with Dr. Gallie the possible uses of these sutures in ophthalmic surgery, it appeared to us that the use of living sutures would be an ideal method of treating ptosis.

The research work upon which Gallie and Le Mesurier have based their clinical work extended over a period of years and was reported in a paper read before this Academy in March, 1921 (1). For a thorough understanding of this study I would refer you to this paper but I do not think that it would be out of place to quote here their conclusions which were as follows:

"(1) When a piece of fascia, aponeurosis, or tendon is cut free from its circulation, and transplanted into such a position in the same animal that it can receive an adequate supply of lymph, it will continue to live, and, for all practical purposes, will continue to live unchanged.

"(2) During the first few weeks following the operation an inflammatory reaction occurs in the tissues surrounding the transplant which results in its complete investment in a vascular areolar membrane and in its healing to those tissues with which it comes into immediate contact.

¹ Read before the Ophthalmological Section of the Academy of Medicine, Toronto, January 9, 1922.

"(3) Such transplants heal to surrounding structures by means of new-formed connective tissue and it is upon the strength of this connective tissue that the firmness of the fixation of the transplant depends. If the operation is performed without the complete removal of the areolar tissue which normally ensheathes the transplant, the union will have merely the strength of areolar tissue. If, on the other hand, the areolar membranes are completely removed and the transplant and the surrounding tissues placed in actual contact, the nature of the union will be in the form of a fibrous scar, which materially increases its strength. As scar tissue, however, is very apt to stretch under even moderate degrees of strain, it becomes essential to place the transplant in contact with the surrounding tissues over a considerable distance in order that the amount of scar tissue in the line of union may be sufficiently strong to withstand any degree of physiological strain.

"(4) In many cases the mechanical difficulties in the way of placing the transplant in actual contact with the surrounding tissues over long distances are so great that the method just described becomes valueless in ordinary operative surgery. These difficulties, however, can be completely overcome by employing the fascia or tendon as a suture and by weaving it securely into the surrounding tissues. In this way, the necessity for removing the areolar membranes from the surfaces is eliminated and one no longer depends upon the healing of the transplant to the surrounding tissues for the success of the operation. The strength of the bond of union will now depend on the strength of the transplant itself and of the structures into which it is woven. If the surgeon is careful to choose for his living suture a material which is known to have the necessary strength to withstand the anticipated strain, and if the suture is securely anchored into tissues which can also tolerate this strain, the permanent union of these tissues can be confidently expected."

For the treatment of ptosis, sutures of fascia lata were chosen as they are of sufficient strength for the desired purpose and are easily obtained.

These fascial sutures can be used to replace other sutures in many of the operations described in the textbooks, that have for their object the substitution of the action of the

frontalis muscle for that of the levator palpebræ, but the writer prefers a modification of the Pagenstecher operation on account of its simplicity, lack of scarring, and good results obtained.

The Operation.—A longitudinal incision is made over the outer side of the thigh, five inches in length. The fascia lata is exposed and cleaned throughout the full length of the wound. Two parallel incisions are then made in the fascia lata 4 to 5mm apart. The piece of fascia between these incisions is then freed from the underlying muscle. Before cutting free this strip at its extremities it should be split longitudinally into the two required sutures as this is more easily done *in situ* than after removal. This part of the operation can well be done by an assistant while the operator is preparing the lid area and later the assistant can be closing the thigh wound while the operator continues with the main part of the operation. In closing the thigh wound the fascia lata should first be carefully closed with catgut. The sutures being prepared, we can now proceed with the lid part of the operation as shown in the diagram (Fig. 1). The sutures are threaded at both ends on to fairly large, slightly curved needles with large eyes. As the sutures are short and slippery, it is necessary to tie them on to the needle with fine strong silk as shown in the figure. A horn plate is placed beneath the lid and two small puncture wounds are made through the skin at A and C with a sharp pointed tenotome, about 6mm above the lid margin. A transverse incision, B-D, 1cm long, is made just above the brow. One needle is now entered at A and carried upwards subcutaneously to emerge at the nasal extremity of the incision B-D. The other needle of the double-armed suture is then entered at A, passed under the skin, brought out at C, re-entered through the same hole and brought out above at the temporal end of the incision B-D. A second similar incision is then inserted in the outer half of the lid. The ends of the sutures are now drawn on until the lid is raised to the desired height and then tied in the transverse wounds. Before cutting off the ends it is advisable to draw the knot out of the wound slightly so that it may be reinforced by passing through and tying around it a fine catgut ligature on a fine curved needle. The transverse incisions are then closed with one or two skin sutures and a

dressing carefully applied. The dressing should be left on for a week.

In December, 1920, I presented before this section of the Academy, a boy, V. W., with a left unilateral congenital ptosis which had recently been operated on by this method. He has been kept under observation since that time and when last seen three weeks ago there had been no tendency to relapse. His present condition is shown in these photographs taken thirteen months after the operation (Fig. 2). One photograph shows the patient with the eyes closed, the other with the eyes open, thus demonstrating the considerable degree of motility of the lid obtained by the operation. In all eight lids in five patients have been operated on by the living fascial suture method by Dr. C. E. Hill and myself at the Hospital for Sick Children; all in cases of congenital ptosis and all with very satisfactory results. Most of these cases have been seen recently and continue to do well.

As a result of our experience I would recommend the strictest possible aseptic technique, which should include a thorough cleansing of the field of operation, shaving the brow and covering over the face with the exception of the immediate area of the lid to be operated on. In four lids of this series more or less infection occurred, but in spite of this infection all did well and in no case was the ultimate result thereby impaired.

Our experience with this method of operation for ptosis is still somewhat limited and the time elapsed since the first case was operated on is too short to judge of the permanency of the result. Nevertheless we believe from the good results obtained so far that we have in the living suture operation a method of treating ptosis that is at least as good as any method previously introduced.

REFERENCE.

1. W. E. GALLIE AND A. B. LE MESURIER. "The Use of Living Sutures in Operative Surgery." *The Canadian Medical Association Journal*, July, 1921.

INDUSTRIAL TRAUMA IN RELATION TO THE DEVELOPMENT OF OCULAR TUBERCULOSIS, SYPHILIS, AND NEOPLASM.¹

BY DR. HANS BARKAN, SAN FRANCISCO, CAL.

IN bringing this subject before you, there are no new facts to present. The literature is large, dating back to the times of Hippocrates. Since the introduction of Workmen's Compensation Laws in Switzerland in 1875, followed by Germany in 1884, Austria, 1887, Norway, 1895 and in our country within recent years, clinical and experimental facts allow certain definite conclusions regarding the relation of trauma to ocular tuberculosis, syphilis, and neoplasm and can be accepted as a working basis. In our country this matter has become of importance to us as ophthalmologists because of our capacity as referee under the Workmen's Compensation Act. We are often required to state our opinion regarding the effect of industrial trauma on the eye as a matter of official record before the court or the Industrial Accident Commission, and in no case do we meet with as much difficulty in forming a definite judgment for the consideration of the Accident Commission and the insurance carrier regarding the medical aspects of the case as in those where trauma plays or seems to play a rôle in the production of ocular tuberculosis, syphilis, and neoplasm. Accidents occur to employees who are suffering from some existing disease or from some preexisting disability; the existing disease may be so marked that trauma plays a secondary rôle in its further development. On the other hand, it may be latent or incipient and its development following trauma throws the responsibility for the development or

¹ Read before American Association of Ophthalmology, Otology, and Laryngology, October, 1921, Philadelphia.

acceleration of the disease process on the trauma. These coincident conditions present many perplexing problems. We must decide to what extent the accident is responsible for the disability. We must decide whether or not the preexisting condition was aggravated by the accident or whether the injury itself was complicated or the healing deferred by the already existing condition. These problems arise with great frequency in the practice of those of us fortunate enough—and I say this with emphasis—to be called upon frequently for industrial service and as referees. There is no part of our work calling for greater thoughtfulness, care, or keener judgment than a fair estimation of the interests and rights of the injured. A careful examination not only of the eye, but of the man, and a careful history are essentials. The compensation to be awarded, the term of compensable disability and the general legal and moral status of the case hinge often on the surgeon's decision with reference to the disease factors mentioned. For this reason it seems pertinent to review shortly the status of trauma to the eye in its relation to tuberculosis, syphilis, and neoplasm.

The great majority of traumatized eyes heal according to the amount of injury and the knowledge and skill of the surgeon. A certain percentage, however, show deviations from the usual which lead us to suspect complicating factors. These factors may be the general poor condition of the patient, some chronic disease, or a local process about the eye such as the teeth, tonsils, or sinus infections, all or any retarding healing. If the injury to the eye is of an industrial character, all complicating factors must be dealt with as part and parcel of the injury. Taking up a specific example, let us consider how syphilis, especially as expressed in interstitial keratitis, plays a rôle. Whether trauma can be regarded as a provocative agent in the production of an interstitial keratitis has long been a moot point, denied by some excellent authorities and as positively affirmed by others. Personally I have seen three cases in which the trauma, its character, and the time relation of the appearance of the interstitial keratitis were clear enough to establish for me at least that trauma as such and in a predisposed individual can stand in direct relation to the appearance of an interstitial keratitis. Iggersheimer, the noted

authority on syphilis and its eye manifestations, denies that trauma as such is a cause, admitting, of course, that there are well authenticated cases following blows, but believing that the appearance of interstitial keratitis is a pure coincidence. Statistically we face the fact that in Breslau among 670 cases, trauma had to be considered only twice. Iggersheimer in 300 cases found not a single case pointing toward trauma. It is also to be remarked that many an eye which has suffered from interstitial keratitis is injured or operated upon without consequences. Iggersheimer in experimenting with rabbits injected through the blood stream in whom luetic manifestations appeared, attempted repeatedly to obtain a specific characteristic by trauma to the cornea, but without success. In spite of a good deal of negative evidence, I believe that traumatic cases are not so infrequent. To explain the process is difficult. Some theories might be considered. We can assume that luetic toxins are in the circulation and that in the cornea in such cases antigens and antibodies may meet and that colloidal precipitation from a blow might start the process. If at a time when possibly such a process is just ready to start of its own accord a sufficient trauma occurs, we can believe that such might act as an activating agent. If now the second eye undergoes the same process a few weeks or months after, it does so independently of the injury to the first one, this first one having been in a sense artificially made, the first one by the activating trauma. The other mode of origin may consist of the direct activation of dormant spirochaetae present in the cornea. As far as I have been able to discover in the literature only one questionable case has been demonstrated pathologically, and in general interstitial keratitis is not taken to be a direct spirochaetal infection. Here the following might be considered. Recent bacteriological investigations have shown that the absence of the causative organism at the time of the examination of the tissues is not uncommon. A few organisms may be activated by trauma, their toxins liberated and thereupon the reaction of the tissues to the toxins forms the clinical picture. When weeks or months after the process the tissue is examined, there may be complete absence of demonstrable organisms. Such may very well be the case in the cornea. Few eyes are lost by interstitial keratitis and these eyes have

been examined a long time after the initial process, so that one can scarcely deny that it may not after all be a direct spirochætal infection. That trauma may play a rôle in activating the process cannot be denied. We have too many examples in general medicine which clearly show that trauma to the bones, joints, or tissues of a syphilitic, acquired or congenital, results in a more complex process of healing and in a stormier clinical picture than otherwise. As long as we are unaware of the pathogenesis of interstitial keratitis, any attempt to explain the effect of trauma is, of course, purely hypothetical. We must acknowledge in fairness to the individual its possibility as a sequence to trauma, provided the following facts are established:

1. The trauma must be positively ascertained and must be more than such as the individual is exposed to in the ordinary course of his employment (for instance dust, chemical fumes, wind, etc.)
2. The trauma must strike the cornea itself, and must cause a definite irritation.
3. It must be estimated by an expert that the interstitial keratitis is not present at the time of the injury, and that the consequences of the injury are an interstitial keratitis.
4. It is finally deemed by some authorities that a definite irritative condition of the eye must exist from the time of the injury to the time of the appearance of the interstitial keratitis. This, however, I do not subscribe to and believe that if trauma *can* induce an interstitial keratitis, a blow on the eye *not* followed by a period of irritation can lead to the appearance of interstitial keratitis.

In tuberculosis of the eye following trauma, our footing is more secure than in the case of syphilis. The activation of pulmonary tuberculosis by chest trauma is well known as is tuberculosis in the bones, joints, glands, and meninges following trauma. These well-known clinical facts are supported by many clear-cut experiments. It is obvious that injury per se cannot cause tuberculosis of a bone or joint or eye. The tubercle bacillus must be present. Autopsy statistics show that over the age of puberty 98% show some hidden or active tuberculous lesion. A sufficient injury may provoke a latent process into action. This injury need not be severe, as pointed

out by Wolff-Eisner. Slight injuries are not infrequently followed by tuberculosis. Mock in his *Industrial Medicine and Surgery* states that trivial trauma is frequently the cause of the development of tuberculosis, and in the eye we have to consider the appearance of tuberculosis following trivial injuries quite frequently. How does a tuberculous iridocyclitis, for instance, develop after trauma? The organism may already be present inactive and be started into activity or the hyperæmia of the iris or small capillary hemorrhages or thrombi establish the iris as a locus minoris resistentiæ. The time relation of the blow to the appearance of tuberculosis of the iris, for example, is interesting. There is no tissue of the human body where we have an opportunity to see as clearly and constantly the development of pathology as in the eye. For this reason it is not surprising that a distinct tuberculous process can be ascertained as occurring within nine days after trauma and be diagnosed as such. In the first two weeks after injury an iritis can only be definitely established as a tuberculous one if actual tubercles appear. These I have seen as early as the seventh day after the injury. It can be presumably diagnosed as tuberculous if the trauma as such would not ordinarily be followed by iritis and if with or without demonstrable tuberculous lesions elsewhere, a focal reaction is obtained with tuberculin.

In discussing the relation of trauma to malignant disease of the eye, we enter upon such a huge field that it is scarcely possible to do it justice in this paper. For a most splendid chapter on the general subject of trauma and malignant disease I would refer you to a paper in *The California State Journal of Medicine*, vol. xix., No. 2, page 54 on "Relation Between Trauma and Malignant Disease from an Industrial Viewpoint," by W. Ophüls. As Ophüls says: "The etiology of 'tumor' is woefully deficient. Whether it is due to abnormality in development, to inflammation, or connected with the more normal processes of hypertrophy and regeneration. Any break in continuity, often the result of trauma, carries with it the possibility of development of true tumor." Clinically we know that repeated and continued traumatic influences are more likely to terminate in tumor than a single trauma. The instances are too numerous and well known to spend time

upon. The relation of single trauma to tumor is much more doubtful and Ophüls states that there is no case so far recorded which proves its existence with scientific accuracy, but there is sufficient evidence to make it justifiable to give the patient for whom the question of insurance depends the benefit of the doubt. The rules have been variously formulated, but there is a very good consensus of opinion on the essentials as follows:

1. The occurrence of the trauma must be proved.
2. The trauma must be severe enough to appear effective.
3. The growth must develop at a place likely to have been injured by the trauma.
4. It must be reasonably certain that the traumatized part was normal before the accident.

5. The time elapsing between the trauma and the appearance of the tumor must agree with our scientific experience in the rapidity of development of the particular tumor under consideration. The time must not be too short, not less than a few weeks, nor too long—the outside limit is usually given at about two years. Ophüls' conclusions are that a single trauma not followed by complications is a rare cause of tumor. We find that Fuchs in 1882 estimated that among 259 choroidal sarcomata examined 11% might have been traumatic. The physician may not mention it frequently in his report, but the patient often states that trauma started the process. We, of course, have to take most of these statements with a grain of salt. Is it conceivable that a choroidal sarcoma may originate from a blow on the eye? Again not knowing the real origin of tumors, we cannot be positive, but it is to me perfectly feasible that a jar or blow sufficient to cause even microscopic alterations in the position of the elements of the choroid might be the starting point of such a case. There may be some slight break in continuity, or some small hemorrhage to disarrange the cells. We have neither time nor space, nor is it the object of this paper to go into the matter of tumor origin. The time element in regard to the injury is even more important than in tuberculosis and syphilis. If we find a tumor developing a year or two years after the trauma it is not in view of the well-known rapid growth of sarcoma, very logical to attribute the tumor to the trauma. If, however, a few weeks or a few months following a well-established blow on the eye we find a

sarcoma developing, we can scarcely deny that there may be a relation between the trauma and the tumor.

By quoting some specific cases, I may bring out certain points in the industrial relation of trauma to syphilis, tuberculosis, and neoplasm.

(1) A. B. Employed in an ice producing plant, the work consisted of loading ice blocks into cars or platforms. While at this work, no eye complaint. Whenever sent to bring ice blocks from dark and cold refrigerator plant out to sun porch notices after three or four days that both eyes become inflamed and painful. This will then last for several weeks. This has occurred six times in the course of the last six years' employment so that he is now never asked to perform this type of work. Saw him ten days after initial symptom. Marked plastic iritis, precipitates on Descemet's membrane, vitreous opacities. Tuberculin reaction highly positive with focal reaction. Fibrosis both apices.

(2) E. H. Delivery boy unloading card board boxes filled with envelopes from automobile. Three boxes approximately weighing fifteen pounds fell from height of three feet. Struck left upper lid. Ecchymosis of lid, subconjunctival hemorrhage. No corneal lesion. Vision normal. Nine days after stated that for last two days the eye had been extremely tender, and that he had almost complete loss of vision. Iris discolored. Eleven small tubercles and three as large as pin-heads. Both upper lobes extensive tuberculous process. Due to rapid extension of process with secondary glaucoma, enucleation.

Pathological Report.—Tuberculosis of iris, ciliary body, and choroid.

(3) F. M. Boy struck by piece of rock on eye. Hemorrhage subconjunctival. Sluggish iritis lasting for three weeks developed two days after blow and then died down. Very marked focal reaction with tuberculin. History of cough, sputum filled with tubercle bacilli, marked cavity formation in both lungs.

In all of these three cases the process was called the direct result of the injury and full compensation awarded.

(4) Washerwoman. Age 32. In wringing out bath towel struck right eye cornea rather forcibly. Seen that day. Epithelial abrasion. Marked photophobia and lacrimation. Symptoms vanished under treatment in

three days. Ten days later she appeared with a beginning vascular type of interstitial keratitis, which ran a typical course. Seen for three weeks, and then did not return so cannot state fate of second eye. Hutchinson's teeth and quite deaf. Wassermann triple plus.

(5) Expressman struck on left eye by trunk strap very forcibly. Iridodialysis. Subconjunctival hemorrhage. Hyphæma. Usual treatment. Three weeks afterwards rapidly developing typical interstitial keratitis. No congenital stigmata. Wassermann XXX. Family history negative. Three healthy brothers. Two healthy sisters. Venereal history denied. Five weeks afterwards the right eye started a similar process.

(6) A. J. Bookkeeper in bank. Age 62. Ledger weight approximately two pounds fell from shelf three feet above. Hit him as he was looking up, striking his left upper lid forcibly. Seen three weeks after injury. Stated, as was confirmed by local eye specialist, that his eye was only slightly bruised and vision normal. Two disk diameter from disk temporally and three papillæ diameter in size, elevated 4 D. a bluish mass diagnosed as sarcoma of the choroid. Tension normal. Vision $\frac{1}{5}$. Enucleation.

Pathological Diagnosis.—Melanosarcoma of choroid.

(7) O. E. Lumberjack in mill. Revolving leather belt caught and threw him. Struck head. Unconscious 10 minutes. Resumed work an hour later. Same day noted and stated to one of the other workmen that he saw nothing with his right eye. Large melanosarcoma. Tension + 1. Seen three weeks after injury. Enucleation. Pathological diagnosis confirms. This man was in good health four years afterwards.

(8) Dr. O. C. Ship surgeon. Swinging rope struck on right eye. States that he knows the eye was normal afterwards, owing to the fact that he made some microscopic examinations a few days after the trauma. Seen three weeks after trauma with mass, chocolate color, in macula. Elevation 4 D. Vision, counts fingers in 3 feet. No tension. Enucleation.

Pathological Diagnosis.—Melanosarcoma choroid.

In the tuberculous cases quoted, it seems quite clear that from the industrial as well as medical standpoint the trauma was the direct exciting cause of the tuberculous lesion.

With reference to the syphilitic cases, there may be some doubt as to the relationship. The blow may only have been incidental and interstitial keratitis might have developed at any time without trauma. When, however, the time interval is so definite in its relation to the trauma as it is in these cases, I believe it hard to assert that the injury has not had a very decided influence in bringing on the attack at that particular time, at the very least.

In the tumor cases, the first and last ones are susceptible of a favorable interpretation. There has been sufficient trauma and there has not been too short an interval before the appearance of the growth. Both men were intelligent and noted their symptoms promptly, and one stated that his vision was normal after the blow and this was confirmed by his attending physician. This, of course, does not mean, as the fundus was not examined, that the man might not have had a beginning tumor at that time, but even if in both of these cases there was a beginning tumor, the question arises, especially from the industrial standpoint, as to whether the growth of that tumor could not have been accelerated by the blow. To that question, if asked us by the referee, we can only say, "Yes," although of course we will qualify this by stating that in any event, the tumor would sooner or later without the blow have reached its maximum effect. Both of these men, are, however, I believe, justly compensable.

The second case—that of the lumberjack struck by the belt—is quite clearly not a compensable case. The man had a tumor out of all proportion to what is possible in the length of time from the injury to the time of the observation. These cases will always claim compensation and we must be positive in our statement to the referee or court that there can be no relationship. We are called upon *only* to express our *medical judgment* and it is left to the Accident Commission or court to determine the compensability. In this compensability many factors play a rôle—the nature of employment, preexisting physical ailments, time relations of effect and cause, questions of negligence, wilful disobedience, absence of common safety devices, etc. It is wise for those engaged in industrial surgery to familiarize themselves with the broad point of view held by most Accident Commissions—a point of view I know certainly held

by the Accident Commission of the State of California. If we report that there is a *likelihood* of relationship between the eye injury and later development of tuberculosis, syphilis, or neoplasm, other factors being equal, it will be decided in the sense that the injury was the direct cause of the disability and the patient compensated accordingly. If we decide that a latent or slight active process in the eye was accelerated or caused to appear active before it otherwise would have done so, compensation is awarded accordingly. If we are absolutely positive that the injury sustained could not in any way have caused the later appearance of tuberculosis, syphilis, or neoplasm, we must state so. We must state so without equivocation, for it is only then that the employer or insurance carrier is given an equal consideration with the employee. The viewpoint is that ordinarily an employer must compensate his injured employee for the entire disability caused by accident, regardless of the effect of poor physical condition of such employee aggravating or complicating the condition. *An employer must take his employees as he finds them.* An exception to this has been made by the Commission of the State of California, however, in 1915. In cases where the duration of the process is unduly prolonged by syphilis, tuberculosis, or chronic varicose ulcers, compensation will be awarded only for the longest period of disability for which a normal person sustaining the same accident would reasonably be disabled. The above seems quite just, for there must be *some* limit when the greater part of the disability is due to the disease and not to the accident.

The appended literature includes only the more important articles, and only those of fairly recent date.

LITERATURE

1. OPHÜLS. "Relationship between Trauma and Malignant Disease from an Industrial Standpoint." *California State Journal of Medicine*, vol. xix., No. 2, p. 54.
2. FUCHS, E. *Sarkom des uveal Tractus*, Wien, 1882.
3. WINTERSTEINER. "Geschwülste d. uveal Tract." *Ergeb. d. Allg. Path. Urbarsch u. Osterlag*, p. 1040.
4. MACK. *Industrial Medicine and Surgery*.
5. GREEF. "Keratitis Parenchym." *Sammlung zwangloser Abhand. aus d. Gebiet d. Augenheilkunde*, i., 8.

6. IGERSHEIMER. *Syphilis und Auge*, 1918.
7. THREIN. *Handbuch der Unfalls Erkrankungen*, II. Band, I. Teil, 1910.
8. WÜRDEMANN. *Injuries of the Eye*.
9. Reports of the Industrial Accident Commission of the State of California, 1914-1920.

THE OCULAR MANIFESTATIONS OF MULTIPLE SCLEROSIS.¹

BY DR. WARD A. HOLDEN, NEW YORK.

PUPILLARY anomalies in multiple sclerosis are rare. Palsies of the ocular muscles are found in but 20% of the cases, are of nuclear origin, are frequently transitory and have no features that are characteristic. Nystagmus or nystagmoid twitching is found in almost all advanced cases.

Our particular interest, then, lies in the consideration of the less easily interpreted optic nerve symptoms, which are of importance, first, in assisting in the diagnosis of multiple sclerosis and, second, in enabling us to make a prognosis that will relieve the patient of the fear of impending blindness. The optic nerve symptoms of multiple sclerosis have long been known and the chief advance in our knowledge of them, recently, has been in the greater precision in determining the defects in the visual field and in the earlier recognition that the symptoms are dependent upon the disseminated disease of the central nervous system.

A paper I read in 1908 on the subject before a joint session of the ophthalmological and neurological sections of the American Medical Association (*Journal of the A. M. A.*, li., No. 2) was illustrated with drawings of the disks and with charts of the corresponding fields in the different types of visual disturbance, and also with photomicrographs showing degeneration of the axial portions of the optic nerves in a case with central scotomata. At that time the ophthalmologist on finding a central scotoma was sometimes content to make a diagnosis of retrobulbar neuritis without going very deeply into its

¹ Read at the second annual meeting of the Association for Research in Nervous and Mental Diseases, New York City, December 28, 1921.

ætiology. The purpose of that paper was to show that a central scotoma of rapid onset, if one could exclude poisoning by chemicals, diabetes, retinal lesions and hysteria, meant as a rule one of two things—either pressure upon the optic nerve from retained secretion in the paranasal sinuses, or multiple sclerosis. A negative rhinological examination, with radiographs of the sinuses, will exclude the sinus origin of central scotoma except in the rare cases in which sclerotic conditions of the sinuses may underlie the trouble. In some of these latter conditions exposure and aëration of sinuses without retained secretion have been followed by improvement in vision, perhaps as exposure of the dura mater in epilepsy is sometimes followed by lessening of the attacks. After exclusion of the sinuses and the other factors mentioned, it is justifiable to make a diagnosis of multiple sclerosis if one or more additional symptoms of that disease can be elicited. But since the visual disturbances are sometimes the earliest symptoms to appear the ophthalmologist whom the patient consults may be puzzled and the neurologist's later examination will not always confirm his tentative diagnosis.

One of the most important of recent papers on the subject is that by Klingmann (*Journal of Nervous and Mental Disease*, 1910, No. 12). He gives in detail the histories of twelve patients with unquestionable multiple sclerosis in which visual disturbances were noted early. The most illuminating and novel feature of his paper is the record of the visual fields. His fields taken carefully with very small test objects show in many cases small absolute multiple scotomata in or near the point of fixation and rather more numerous in the temporal than in the nasal portion of the field. With his small test objects he found as many as sixteen minute *absolute* scotomata in cases in which earlier examiners might have noted only a single large diffuse *relative* scotoma. The tendency to-day is to use small test objects and thus obtain more accurate fields.

The symptoms on which Klingmann insists as corroborative of the diagnosis of multiple sclerosis when a central scotoma is found are ankle clonus and the Babinski toe reflex. It is surprising that in no case history does he mention the state of the abdominal reflexes. Yet diminished abdominal reflexes are found in multiple sclerosis as frequently as the Babinski reflex,

namely, in about 80% of cases. And we now have learned that if the other common causes of central scotoma can be eliminated, diminution of abdominal reflexes warrants us in diagnosing multiple sclerosis, even if no other symptoms are present. And often no other symptoms appear for years. It is understood that we exclude the diminution of abdominal reflexes that may be found with hysterical anaesthesia.

The Optic Nerve Changes.—The characteristic plaques develop in the optic nerve or tract at any point, but with great frequency in the axial fiber-bundle of the optic nerve. The axones from the ganglion cells in the macular region of the retina—the center of distinct vision—run in the temporal portion of the optic disk and further back in their course reach the center of the optic nerve to form the so-called axial bundle. This is a sensitive bundle which is particularly affected by toxic agents and by diffuse pressure upon the optic nerve.

In the plaque the inflammatory exudation at first merely compresses the optic nerve fibers and interferes with their function. Later the medullary sheaths break down and the glia tissue proliferates, but since the axis cylinders are not destroyed, restitution of vision frequently takes place. In the beginning if the inflammatory plaque lies near the optic disk, there may be congestion or a low degree of oedema of the disk, but if the plaque lies far back in the nerve the disk for a time appears normal. However, after an interval, ranging from one to six weeks, pallor of the disk usually appears and remains permanently, even though vision is restored to normal again.

The pallor of the disk varies with the extent and location of the plaques and for descriptive purposes it has been classified as of three varieties: (a) a pronounced whiteness of the disk in its entire extent; (b) a slight pallor of the disk in its entire extent and (c) a pallor of the infero-temporal third of the disk with the other two thirds normal in color.

The first and second varieties—diffuse pallor—are found also in tabic and other general atrophies, while the third—temporal pallor—indicates an involvement of the axial or papillo-macular bundle alone. This is the variety of pallor frequently found in multiple sclerosis and it is, to a certain degree, characteristic of this disease.

In some cases there is considerable difficulty in interpreting

pallor of the optic disk. In health its temporal half is always paler than its nasal half and occasionally in healthy persons with normal vision one disk is distinctly paler than the other. Furthermore, in some cases of multiple sclerosis pallor of the temporal half of the disk is found while acuteness and field of vision are still normal. This suggests either that there may have been a slight involvement of the nerve which had not yet disturbed its function, or, that there may have been earlier disturbances in the field of vision of which the patient had not been conscious and from which recovery had taken place. The appearance of the optic disk, therefore, has less diagnostic significance than the acuteness and the fields of vision.

The Fields of Vision.—The defective fields in multiple sclerosis are of three types: (a) peripheral contraction; (b) central or paracentral scotoma, and (c) a combination of both peripheral and central defects. Many observers find peripheral contractions with considerable frequency, but it is quite certain that in a number of these cases the defect is of functional rather than of organic nature. We have been accustomed to speak of a peripheral contraction, often increasing as the test continues, as a functional or fatigue field which is found in the neurasthenic or hysterical. The present day interpretation of this fatigue field is that it is suggested by the examiner to a patient susceptible of suggestion. In multiple sclerosis the mental state of the patient is often one in which suggestions are readily seized upon. Hence, while at times there may be definite constant peripheral defects in the field due to a lesion in the optic nerve, we yet view with suspicion records of a more or less uniform contraction of the entire periphery of the field and regard many of these contractions as being of a functional nature and suggested to the patient through defective technique in taking the field.

The more characteristic defects in the field are the central and paracentral scotomata. In these cases again great care must be taken in the tests which must be carried out quickly with very small test objects, for the patient soon becomes confused and his answers contradictory. When there are very small absolute and larger relative defects no two observers may obtain identical fields. In case of paracentral scotomata the patient may be aware of disturbed vision while his central

acuteness of vision is normal with the test cards, and some searching may be required to find the small defects in the field that the pallor of the disk leads us to suspect.

The combined form of peripheral contraction and central scotoma is not infrequent. Here, too, a distinction must be made between the functional and the true defects. In advanced progressive cases almost every form of field may be found, even homonymous hemianopsia.

Course and Diagnosis.—The onset of the visual disturbance is acute in half the cases and in a large percentage both eyes are affected. The maximum disturbance of vision may be reached in a few days and recovery may take place in an equal time. Again the disturbance of vision may long remain stationary, then either improve or grow worse, and remissions, relapses and extensions may alternate for years. With a central scotoma the patient cannot read, but he can go about without difficulty, and unlike atrophies of the optic nerve of other origin this variety never leads to blindness, and a reassuring prognosis may always be given.

When the visual disturbance is the first symptom noticed and a central or paracentral scotoma develops within a few days without pallor of the disk, the differential diagnosis between multiple sclerosis and hysteria is often most difficult. The patient with multiple sclerosis may exhibit hysterical manifestations and an adequate psychic trauma may be discovered. The vision may improve slowly or remain stationary, but after a lapse of weeks a pallor of the disk appears which confirms the diagnosis of organic disease.

There is no difficulty in distinguishing between the optic nerve disturbances of multiple sclerosis and those of tabes. It may be difficult, however, to distinguish between them and those of disseminated myelitis in the rare cases in which visual symptoms of myelitis precede the spinal symptoms. In my own observations of disseminated myelitis, however, the visual disturbance in half the cases conformed to the type of lateral hemianopsia in the field of one eye only, which is very rare in multiple sclerosis.

In summing up we may say that defective vision in one eye or both, generally of acute onset and mostly with one or more small scotomata at or near the point of fixation, is a common

symptom of multiple sclerosis that may come on at any time, but often appears early in the disease. A rhinological examination should exclude the paranasal sinuses as causative factors and then in many cases we must exclude hysteria. The early organic signs on which we rely for the exclusion of hysteria are diminution of the abdominal reflexes and the presence of the Babinski reflex and ankle clonus.

PRIMARY INTRANEURAL TUMORS (GLIOMAS) OF THE OPTIC NERVE.

A HISTOLOGIC STUDY OF ELEVEN CASES, INCLUDING A CASE SHOWING CYSTIC INVOLVEMENT OF THE OPTIC DISK, WITH DEMONSTRATION OF THE ORIGIN OF CYTOID BODIES OF THE RETINA AND CAVERNOUS ATROPHY OF THE OPTIC NERVE.¹

By DR. F. H. VERHOEFF, BOSTON, MASS.

(*With twelve illustrations on Text-Plates VIII.-X.*)

HUDSON² in his classical paper on primary tumors of the optic nerve concluded that the great majority of these tumors consisted essentially of neuroglia. Thus, on analyzing 154 cases collected from the literature, he found that 118 tumors were gliomatous, or not improbably gliomatous, although only twenty-eight were originally reported as of that nature. Of the thirty-five tumors that were not gliomatous, he regarded twenty-four as certainly endotheliomas, five as probably endotheliomas, and six as fibromatoses of the nerve sheath. The gliomatous tumors arose from the nerve stem and were, of course, all primarily intradural; but Hudson rightly objected to the classification of tumors of the optic nerve into intradural and extradural tumors, because tumors of entirely different nature, endotheliomas,³ are also frequently intradural. A better classification, it seems to me, would be into tumors

¹ From the Massachusetts Charitable Eye and Ear Infirmary.

² Hudson, A. C.: Primary Tumors of the Optic Nerve, *Roy. Lond. Ophth. Hosp. Rep.*, xviii., 317, 1912.

³ This term, which is generally applied to the common tumors of the meninges, is really a misnomer, since according to embryologists the meninges are not lined by endothelium but by mesenchymal epithelium.

arising in the nerve stem (intraneurial), and tumors arising in the nerve sheath (extraneurial).

In this communication I shall confine myself to the consideration only of primary tumors of the optic nerve stem, since these tumors are evidently entirely different from those arising in its sheath.

In spite of Hudson's paper, considerable doubt still seems to remain concerning the exact nature of the primary intraneurial tumors of the optic nerve, and Hudson himself did not regard them as true gliomas.

Within the last twenty years, three such tumors have been submitted to me for examination, and through the courtesy of colleagues, sections of eight other cases have been made available to me for study. Thus, having sections of eleven cases to compare directly with one another, I am enabled, perhaps, to acquire a somewhat better conception of the structure and nature of these tumors than could be obtained by the study of a single case, or by an attempt to interpret the various descriptions of the numerous isolated cases reported in the literature. One of my own cases (Case 1) I report herewith in somewhat greater detail than the others because both clinically and histologically it showed features not hitherto observed, and other features, I believe, hitherto not correctly interpreted. For the early clinical data of this case I am indebted to Dr. J. W. Cahill, who referred the patient to me. For the privilege of reporting the clinical features of Case 2, I am indebted to Dr. Alexander Quackenboss. For the sections or tissues from cases 4, 5, 6, 9, and 10, I am indebted to Drs. de Schweinitz, E. F. Krug, James Ewing, Louise Meeker, E. C. Ellet, M. Cohen, and R. G. Reese. The last four cases have been reported elsewhere, with brief histologic descriptions, which, as will be seen, are somewhat at variance with my own interpretation of the tumors.

CASE 1.—Glioma of the optic nerve, mixed coarsely reticulated and spindle-cell type. Gliomatous involvement of the optic disk and retina, with formation of large prepapillary cyst. Normal vision up to four years previous to operation.

History.—J. R., boy, was 14 years old at the time of operation. His father, mother, and their seven children had normal eyes. There was no relationship between the parents,

and no congenital anomalies in any of the children. The Wassermann test of both parents was negative. The patient had never had any known injury to the head. He had measles at 5 years, otherwise he had had no infectious diseases. At the age of 8, 9, and 10, school tests showed normal vision in both eyes.

At the age of 11, the patient noticed that he could not see to shoot his air rifle as formerly. Six months later, a school test showed no vision in the right eye. Soon afterward, December 12, 1916, he was brought to Dr. Cahill, who found the right eye practically blind and showing papilloedema of about 4 diopters. August 28, 1917, at the age of 12, he was referred to me by Dr. Cahill and was admitted under my charge to the Massachusetts Charitable Eye and Ear Infirmary. At this time, there was slight exophthalmos of the right eye, and papilloedema of about 5 diopters. Vision of the eye was reduced to light perception with faulty projection. The general physical examination was negative except for very slight glandular enlargement—cervical right axillary and epitrochlear. Roentgenograms of the orbit, sinuses, and sella turcica revealed nothing abnormal, and a Wassermann test was negative. A probable diagnosis of tumor of the optic nerve or orbit was made, but operation was refused.

August 30, 1919, at the age of 14, he was again referred to me by Dr. Cahill and again admitted to the hospital. There was now moderate exophthalmos of the right eye, outward and downward, and limitation of motion outward and upward. The lids could be easily closed. There was no congestion of the globe or conjunctiva. The globe could be pushed back into the orbit, but no tumor mass could be felt on palpation of the surrounding tissue. A roentgenologic examination yielded negative results. The vision of the eye was nil.

On ophthalmoscopic examination, there was seen at the site of the disk and extending about 9 diopters into the vitreous, a sharply defined globular mass, grayish in color, over which the retinal vessels coursed. On its surface were reddish areas indicating that the tumor was really a cyst through which a red reflex could be seen in places. There were also small hemorrhages on its surface which extended into the vitreous. The latter also contained numerous web-like opacities. Around the macula there were numerous white spots, the largest having a diameter about twice that of a large retinal vein, situated beneath the vessels. Near the macula was a small round spot faintly mottled with pigment. The fundus was otherwise normal except for a slight stippling somewhat suggestive of hereditary syphilis.

The left eye was normal and had normal vision.

September 12, 1919, under ether, the right eye, with the large tumor attached, was removed.

The socket was subsequently treated with radium. In spite of the large size of the tumor which had been removed, the artificial eye ultimately worn by the patient did not appear more deeply set than the left eye.

PATHOLOGIC EXAMINATION.

Macroscopic Examination (3980).—The specimen consists of the globe with the tumor attached. The latter is roughly ovoid in shape (Fig. 1), extends from the globe backward 24mm, and measures 2cm in its greatest cross diameter. At its connection with the globe, it is constricted to 3mm in diameter, while its posterior cut end is 6mm thick.

The optic disk is replaced by a nodule, 5.5mm in its greatest cross diameter and 4.5mm high, which slightly involves the retina. Within its summit is a cyst 2.5mm in diameter. Around the nodule, the retina shows several slight separations. The globe otherwise appears normal.

On section, the extraocular portion of the tumor is found to be entirely within the dura, the latter forming a capsule for it. At the lamina cribrosa the nerve stem is 2mm in diameter. Posteriorly, it then gradually enlarges until it attains a diameter of 12mm, after which it gradually narrows again. From the periphery of the nerve, most noticeably at the thickest portion on one side, an exuberant growth of tissue has taken place which has distended the subdural space in ampulliform fashion and which now forms the main mass of the tumor. At the cut end of the tumor, this tissue is almost absent, so that the tumor here consists almost entirely of the thickened nerve stem.

Microscopic Examination (Fixation of large piece of the tumor in Zenker's solution, the globe with tumor attached, in 10 per cent. liquor formaldehydi containing 38 per cent. alcohol, for forty-eight hours, followed by immersion in acid alcohol for twenty-four hours. Celloidin sections were made along the axis of the optic nerve and through the middle of the tumor. Staining in hematoxylin and eosin, Mallory's connective tissue and neuroglia stains, and Verhoeff's elastic tissue stain).

The optic nerve fibers are atrophic throughout, their myelin sheaths failing to stain. The lamina cribrosa is curved backward and thickened, owing chiefly to increase in its spindle cells. Just behind the lamina cribrosa, the nerve fibers have been replaced by neuroglia just as in a case of advanced glaucoma. The glia cells are thickly set, irregu-

larly arranged, and have thick processes which stain strongly in eosin.

Farther back, the structure of a normal nerve is to a great extent maintained, the enlargement of the nerve stem being due to a great increase in its neuroglia within the interseptal spaces. The neuroglia here consists of a finely fibrillated matrix, the fibrils running predominantly in a longitudinal direction. Embedded in this are cells usually with long oval nuclei and a small amount of feebly staining cytoplasm, which is often vacuolated. The cells freely communicate with one another by delicate processes, thus forming a syncytium. Many of the cells are abnormally large and some are multinucleated. A few of the cells contain hematogenous pigment. For a considerable distance, the fibrous septums maintain a normal arrangement, simply becoming more widely separated as the nerve expands.

The pia has been destroyed everywhere or rendered unrecognizable. Near the globe, the subdural space is distended by coarsely reticulated hyaline tissue, which has evidently resulted from proliferation of so-called endothelial cells of the arachnoid. Posteriorly, this tissue intermingles with the tumor tissue.

The growth within the subdural space in general appearance differs greatly from that within the nerve stem, but, nevertheless, shows some resemblance to it. The cells are still generally arranged in more or less definite bundles, but the latter do not run in any one general direction, as they do in the nerve stem, and the cells have longer and thicker processes. The nuclei are usually large and oval in shape. Where the arrangement into bundles is most definite, the cells are spindle-shaped. Throughout the tissue, especially between the bundles, there are numerous irregular spaces of various sizes, often giving an appearance closely resembling that seen in cavernous atrophy of the optic nerve. While most of these spaces are microscopic in size, some are actual cysts and reach a diameter of $2mm$. The smaller spaces are either apparently empty or filled with dilute serum. Some of the larger spaces contain serum alone (Fig. 4), others, in addition, contain a small amount of fibrin, a few blood corpuscles, and free large round or stellate cells. These cells appear to be neuroglia cells derived from the cells bordering the spaces.

The smallest of the spaces can be seen to be vacuoles situated within the cytoplasm of the glia cells. Some of these cells contain each a single vacuole, but more often each cell is distended with numerous vacuoles. As in these situations, the cells are more or less stellate in form and connected with one another by their processes, the structure may be de-

scribed as a reticulated or vacuolated syncytium of neuroglia. All of the other spaces, including the cysts, have evidently resulted from smaller spaces breaking into each other.

The connective tissue stroma, as revealed by Mallory's anilin blue stain, is for the most part limited to a small amount accompanying the blood vessels. At the periphery, however, it is fairly abundant, the dura here sending numerous trabeculae into the tumor. The appearance of regularly arranged fibrous septums such as are seen in the nerve stem, is in the main body of the tumor almost entirely lacking. Elastic fibrils are present only within the connective tissue stroma and in the walls of the blood vessels. The stroma is often involved by the neuroglia of the tumor, the involving tissue then assuming the spindle-cell type. The tumor is poorly vascularized but shows no areas of necrosis. It is practically free from chronic inflammatory infiltration, although in some places there is slight infiltration with lymphoid cells. Along the dura, there are numerous corpora aranacea, most of them calcified.

The optic disk is entirely replaced by an overgrowth of neuroglia, which also involves the retina for a short distance, from 1 to 3 mm around it. This tissue displays in general the same structure as that of the subdural growth, the reticulated or vacuolated structure being especially well marked. At the summit of the disk the neuroglia has proliferated into the vitreous body (Fig. 2), forming a polypoid nodule; and it is within this nodule that the large cyst seen ophthalmoscopically occurs. This cyst is identical in appearance with the smaller cysts in the body of the tumor and has evidently been produced in the same way. It measures 2.5 mm in diameter and contains dilute serum and a small amount of fibrin. At the margin of the nodule there is a similar cyst about 1.25 mm in diameter. Within the nodule, the vessels are greatly congested, and there are groups of actively proliferating capillaries. In the wall of the larger cyst, there are small blood extravasations. These conditions are no doubt due to venous stasis.

The retinal involvement on one side of the nodule differs markedly from the rest of the tumor. Only the nerve-fiber layer is affected. This gradually becomes thickened as the nodule is approached, until it is about three times its normal thickness. This thickening is not due to extension of the tumor into the retina, but to proliferation of the preexisting neuroglia. Müller's fibers have increased in size and number and preserve their vertical arrangement, while the other glia elements have also greatly increased.

On the opposite side of the nodule, the nerve-fiber layer is thickened in the same way but to a less degree, and here an

exuberant growth of neuroglia has taken place beneath the retina. Within this tissue, the smaller cyst, noted above, occurs, and there are also a few large islands of cells, evidently derived from the pigment epithelium, some of which contain autochthonous pigment. Some of these islands have become converted into colloid material similar to that in colloid excrescences of the choroid.

Extending from this tissue, for a distance of about 3mm between the pigment epithelium and rods and cones, and in places completely destroying the latter, is a thin layer of neuroglia in which the cells are mostly spindle-shaped. In some sections, this layer appears discontinuous so that the appearance is produced of localized areas of neuroglia which replace the layer of rods and cones or contract it so as to form pseudorosettes. No doubt these were the white spots seen ophthalmoscopically. Aside from these changes, the retina is everywhere normal except for complete atrophy of its ganglion cells.

The vitreous humor contains a moderate amount of serum, and near the tumor, a slight amount of fibrin and many epithelioid cells with stellate processes. The other ocular structures are normal. Cytoid bodies (Figs. 10 and 11) are extremely numerous in the subdural growth and optic disk tumor, but are scanty in the nerve stem. A few are present in the retina. (See below.)

Differential Neuroglia Stain.—In general, the tumor shows only moderate tendency toward the production of differentiated neuroglia fibrils. In the nerve stem, they appear to be practically absent except in the vicinity of the lamina cribrosa, where they are fairly abundant. It is possible, however, that after the method of fixation employed for this portion of the tumor, very fine neuroglia fibrils may fail to stain differentially. In the subdural portion of the tumor, at least a few fibrils can be found in every field. They are abundant near the periphery, and wherever the cells are spindle-shaped and closely packed together (Fig. 9). They are also abundant in the tumor of the optic disk. Under high magnification, the stainable substance in the fibrils often appears granular. In some instances, a fibril stains for a short distance, then becomes almost colorless, then stains again. In the thickened portion of the retina, the glia fibrils stain strongly, and are unusually large in caliber and length. The differentiated fibers are, in fact, more abundant here than anywhere in the growth, and tend to maintain a normal arrangement.

CASE 2.—*Glioma of optic nerve, spindle-cell type. Death from meningitis following operation.*

History.—J. O'G., boy, aged 4 years, admitted to the Massachusetts Charitable Eye and Ear Infirmary, January 13, 1915, under the care of Dr. Quackenboss, with a history of protrusion of the left eye which had been noted by his parents for two years, presented no history of trauma. The general examination was negative.

February 20, 1915, the globe and tumor were removed intact. February 21st, the temperature was 103 F. February 22d, the patient showed symptoms of meningitis; stiff neck, Kernig's and Babinski's signs. February 23d, the patient died. Necropsy was not permitted.

PATHOLOGIC EXAMINATION.

The tumor (2700, Fig. 3), which is entirely intradural, is ovoid in shape and begins at a point 12mm behind the globe and extends backward 34mm. Its greatest cross diameter measures 21mm. At its posterior cut end, the nerve returns almost to normal size, being here 3.75mm in diameter. Between the globe and the tumor, the nerve stem is only 2mm in thickness. The subdural space is here greatly distended with fluid and partly filled up with proliferated arachnoid tissue, which has been invaded by the tumor from behind. On section, the tumor is found to consist primarily of an enlargement of the nerve stem. The latter reaching a thickness of 12mm. At its thickest portion, the tumor has broken through the pia and greatly distended the subdural space in all directions.

In the relatively normal portion of the nerve, special staining shows persistence of a considerable number of medullated nerve fibers. Beginning at the globe, the nerve stem shows marked increase in its neuroglia cells, many of the new cells being spindle-shaped. As the nerve is followed backward, the spindle cells increase in number until the nerve passes insensibly into the tumor proper. As the spindle cells increase in number, coarse neuroglia fibrils begin to appear between them, and the nuclei of the cells become less uniform in size. In the tumor itself, almost all of the cells are spindle-shaped and are arranged in more or less definite bundles running in various directions, so that the appearance of a spindle-cell sarcoma is closely simulated. Between the bundles are numerous nucleated strands staining deeply in eosin, which in hematoxylin and eosin specimens at first glance appear to consist solely of fibrous septums. The differential neuroglia stain, however, show that these strands consist chiefly of coarse neuroglia fibrils and their accompanying spindle cells, running along and within delicate connective tissue septums (Fig. 5). These strands are

present throughout the tumor but are largest and most numerous in the intervaginal portion of the growth. The less definite bundles between the strands also contain numerous neuroglia fibrils, but here they are finer in caliber. Vacuolization of the cells is not a conspicuous feature of the growth, but in a few places, especially in the intervaginal portion, it is well marked and has led to the formation of a few small cystic cavities. The connective tissue stroma, as brought out by Mallory's connective tissue stain, consists of delicate septums which are accompanied and invaded by the tumor cells as just described. The blood vessels are small and few in number. Elastic tissue is present only in the stroma. Cytoid bodies are abundant and are most numerous in the strands containing coarse neuroglia fibrils. The optic disk is not cupped or elevated. Its normal structure has been entirely replaced by neuroglia. The cells of the latter are small in size, thickly set, irregularly arranged, and show marked vacuolization. The retinal ganglion cells have completely disappeared in the macular region, but an occasional one can be recognized elsewhere. Otherwise the globe is normal.

CASE 3.—*Glioma of optic nerve, mixed, finely reticulated and spindle-cell type.*

History.—F. L., boy, aged 7, was admitted to the Massachusetts Charitable Eye and Ear Infirmary, March 15, 1894, with a history of exophthalmos of three years' duration, left eye. Ophthalmoscopic examination showed papillcedema and tortuosity of retinal veins. The globe, with a large tumor of the optic nerve, was removed, at least half of the tumor being left in the orbit.

PATHOLOGIC EXAMINATION.¹

(2629). The globe is normal with the exception of slight papillcedema and atrophy of the retinal ganglion cells. The tumor of the nerve begins 6mm behind the globe and rapidly reaches a cross diameter of 24mm. The nerve itself reaches a diameter of 12mm. The subdural space is distended with the tumor growth except anteriorly, where it is filled with tissue resulting from proliferation of the arachnoid. Weigert's preparation shows complete atrophy of nerve fibers of optic nerve. Histologically, the intraneuronal portion of the growth is so remarkably similar to that of Case 8 that a separate description of it is unnecessary. Between the tumor and the globe the nerve shows simple atrophy without gliosis,

¹ The specimen was not submitted to me for examination until 1915.

except posteriorly, where its neuroglia by gradual transition assumes the character of the tumor. The intervaginal portion is so similar to that of Case 2, that the same description may be applied to either. Vacuolization of the cells is well marked, there are numerous small cysts, and cytid bodies are abundant in places.

CASE 4.—*Glioma of optic nerve, finely reticulated type, associated with glioma of the hypophysis.*¹ The following clinical data were obtained from Dr. de Schweinitz's very full notes on this case: A boy, 12 years old at the time of operation, presented nothing of importance in his family history, but when he was between his third and fourth years he had suffered from convulsions; one convolution also occurred in his sixth year. Exophthalmos was first noted when the child was about 5 years of age, and gradually increased, with progressive atrophy of the optic nerve without preceding neuritis or choking of the disk. Roentgen-ray examination indicated absorption of bone or bulging of the walls of the orbit outward, but nothing else.

A general physical examination made by Dr. Stengel, July 11, 1908, showed overdistention of the veins of the neck, decided enlargement of the heart, without evidence of valvular disease, indications of pericardial adhesions, and some congestive enlargement of the liver.

At the age of 8, the vision of the right eye was $\frac{6}{60}$, and there was a large complete central scotoma. At the age of 10, the vision was $\frac{5}{60}$.

At the time of operation, June, 1911, vision was reduced to light perception, the eyeball was displaced forward and downward, and Hertel's instrument recorded 30mm.

At operation, a neoplasm, not unlike the shape of the eyeball itself, was found growing from the optic nerve, with a

¹ A brief preliminary report of this case was made in 1912 by Dr. de Schweinitz (*Tr. Sec. Ophth., Coll. of Phys. and Surg., Philadelphia, Jan. 18, 1912*) before evidences of the pituitary growth had appeared. Through some fault in technic, the sections made of the tumor were stained so poorly and the tissue elements were so shrunken that Dr. de Schweinitz decided not to give a further report of the case and the specimens were mislaid. He was able, however, to find one large section of the tumor of the nerve which he kindly sent me, and from which I was readily able to make out the details described above and arrive at a positive diagnosis. He also kindly sent me sections of the tumor of the pituitary body which had been sent him from the hospital where the second operation was performed. I desire here to thank Dr. de Schweinitz for his extreme courtesy in permitting me to report the clinical features and my pathologic findings in this highly unusual case.

small portion of uninvolved nerve between the anterior part of the growth and the posterior portion of the eyeball. The growth was dark red, entirely encapsulated, 3.5cm in length, 2.5cm in width and 3cm in depth. On section, it was seen that the tumor proceeded from the nerve in a fan-shaped area and was entirely covered by a dural capsule. It was composed, in general terms, of a connective tissue, through which were scattered numerous nuclei, together with swollen and oedematous nerve fibrils. In some of the sections, cells suggesting ganglion cells were present.¹

When seen in 1916, four years after operation, there was no recurrence of the tumor in the socket, but the boy had grown very tall and slender. Since he showed symptoms of intracranial involvement, he was placed under the care of a brain surgeon in Philadelphia. In 1917, he went to a hospital in another city, and the following note on the case was sent to Dr. de Schweinitz:

"When we saw him he had a moderate grade of choked disk, with upper temporal restriction of the color fields. A suprasellar exploration was made and revealed an hypophyseal tumor, apparently without any direct continuation along the nerve sheath, which extended up into the third ventricle sufficiently far to produce an obstructive hydrocephalus. Portions of the tumor and of the right optic nerve were removed. The former is an hypophyseal struma made up largely of colloid material,² while the optic nerve shows a gliomatous infiltration. It was thought impossible to radically remove the tumor. Only a decompression was done, the effect of which on the visual fields has not as yet been determined."

Shortly afterward, the patient died.

Microscopic Examination.—The section of the optic nerve tumor includes a portion of normal optic nerve and the largest part of the growth. The tumor has not broken through the pia, so far as can be determined from this one section. In structure, it is extremely simple and uniform throughout. It consists essentially of small cells with small round nuclei, which form a finely reticulated and vacuolated syncytium. The vacuolization, which is extremely marked, is rendered unduly conspicuous by the shrinkage resulting from the method of preparation. The transition of the normal nerve into the tumor is gradual. In fact, the tumor differs in structure from the neuroglia of a normal optic

¹ The only structures that I find in the tumor that might be mistaken for ganglion cells are cytoid bodies.

² In my opinion, this was undoubtedly serum, sometimes containing fibrin.

nerve chiefly in that it is much more highly reticulated and vacuolated. It contains numerous small cysts filled with serum. Cytoid bodies are extremely numerous, and are brought out with unusual distinctness by the method of preparation.

In many places, the tumor is almost identical in structure with the intraneurial portion of Case 8 (Fig. 8).

Tumor of the Hypophysis.—This is, in general, composed of cells which are highly vacuolated and form a reticulated syncytium. As a result of the extreme vacuolization, numerous irregular cystic spaces filled with serum have been formed. The nuclei of the cells are usually round or slightly oval. Running through the tumor are numerous bundles of spindle cells accompanied by coarse fibrils, many of which are spiral in form, and which stain deeply in eosin and are easily recognized as neuroglia fibrils (Fig. 6). Numerous finer fibrils are also seen between the other tumor cells. The cells show a decided tendency to arrange themselves radially to the blood vessels. Typical cytoid bodies are occasionally seen in the tumor. The structure does not suggest that of a normal optic nerve, but does strongly suggest a derivation from the pars nervosa of the hypophysis. The tumor nowhere contains cells similar to those of the pars anterior of the hypophysis.

One section, labeled "optic nerve," shows at one end a small bit of normal nerve tissue, removed either from the optic nerve or optic chiasm. At the other end, it shows tissue consisting of a delicate reticulated syncytium, which, allowing for the difference in methods of preparation, is identical in appearance with portions of the orbital tumor. It, however, is free from cysts and cytoid bodies.

This tissue has invaded a structure, which, judging by the presence within it of numerous coarse longitudinal fibrils, is the stalk of the pituitary body, and here has taken on the character displayed by the pituitary growth.

CASE 5.—*Glioma of optic nerve, mixed coarsely reticulated and spindle-cell type. Removal of tumor without globe, followed by retinitis proliferans* (case of Dr. Krug's, not previously reported.)¹

History.—A girl, aged 19, had exophthalmos and disturbed motility of the eye. The eye was blind. A tumor of the optic nerve was removed by a modified Krönlein operation, without the globe, September, 1913. The globe later showed choroidal changes and retinitis proliferans. About

¹ A section of the tumor was sent to me by Dr. James Ewing, and several sections of the globe were furnished me by Dr. Louise Meeker.

five years after removal of the tumor, it showed increase of tension and signs of iridocyclitis, and was removed on account of pain.

Microscopic Examination of the Tumor.—The section does not include a portion of the uninvolved nerve, and is not cut in such a way as to show the general topography of the tumor. The latter consists of two types of tissue which are intimately intermingled. One type consists of spindle cells with coarse fibrils running between them; the other of a coarse cell reticulum containing numerous irregular spaces. The spindle-cell type is occasionally arranged in fairly definite bundles, but more often occurs in irregular masses which undergo abrupt transition into the second type of tissue. No large cysts have been found in the tumor, and cytoid bodies are few in number, although present.

Microscopic Examination of the Globe.—The cornea is normal. The anterior chamber is not obliterated and contains serous coagulum. The iris shows marked fibrosis and ectropion uveæ, the pigment epithelium on one side extending over the anterior surface almost to the root of the iris. There is peripheral anterior synechia on both sides. The pupil is free from membrane, and there are no evidences of posterior synechiae. The lens is *in situ* and not highly cataractous. The retina is almost completely separated, but not applied to the back of the lens. Arising from both sides from just behind the ciliary processes to the ora serrata is a massive cyclitic membrane of loose texture which extends over the surface of the separated retina and into the folds of the latter. Posteriorly, it becomes densely fibrous and shows marked ossification. The cyclitic membrane also contains numerous hemorrhagic extravasations, some of which are undergoing organization. At the fundus, the retina is still adherent to the choroid in one place, and by traction has caused a slight separation of the choroid. The ciliary body and the anterior choroid are also slightly separated from the sclera by traction of the cyclitic membrane. The retina shows the hyperplasia usual under such conditions, and in addition, marked pigmentation with autochthonous pigment.

The choroid has taken on an abnormally fibrous structure, but does not show extreme atrophy. The optic nerve and disk are not included in the sections. Owing to the absence of posterior synechiae and pupillary membrane, it is unlikely that iridocyclitis was the primary pathologic condition in the eye. The picture is consistent with a condition of retinitis proliferans which has caused separation of the retina and degenerative changes leading to a secondary cyclitis.

CASE 6.—*Glioma of optic nerve, chiefly finely reticulated type*, (case of Dr. Krug's, not previously reported).¹

History.—A girl, aged 15, had exophthalmos of the left eye. The eye was blind. A large tumor of the optic nerve was removed without the globe by the Krönlein operation. One year later, the globe showed extensive pigmentary degeneration of retina and choroid.

Microscopic Examination.—Both celloidin and paraffin sections were available for study, the latter being exceedingly thin. One paraffin section, I removed from the slide and restained for neuroglia. Although the fixation was in liquor formaldehydi, by overstaining in Verhoeff's elastic tissue stain and then staining in phosphotungstic hematoxylin, I obtained satisfactory differentiation of the neuroglia fibrils.

The sections do not give an idea of the general topography of the tumor, and do not include any portion of the uninvolved nerve. The tumor is made up of two types of neuroglia. The first type, which greatly predominates, consists of a finely reticulated neuroglia syncytium containing irregular spaces, each of the largest of which is in width about three times the diameter of a large nucleus (Fig. 7). The nuclei vary considerably in size, and are round, oval, or sometimes slightly triangular in shape. Each is immediately surrounded by more or less cytoplasm, which sends out communications to the other cells, so that the characteristic appearance of so-called spider cells is produced. Often one or more minute vacuoles occur in the cytoplasm near the nucleus, and transition stages from these to the large spaces in the syncytium can be made out. It is evident, therefore, that the larger spaces have resulted from the enlargement and breaking into one another of the smaller definite vacuoles within the cytoplasm, while the syncytial reticulum is simply the thinned out cytoplasm and cell membranes remaining around the large vacuoles. In the section stained differentially, fine neuroglia fibrils can occasionally be seen running along the trabecula of the syncytium. With more suitable fixation, these would no doubt appear more abundant. The other type of tissue consists of so-called spindle cells with coarse neuroglia fibrils running between them. This tissue generally occurs in the form of bundles along and within the connective tissue septums, dividing the first type of tissue into more or less definite lobules. The bundles also occur, however, without any relation to the stroma. When this is the case, the transition of one type of tissue into the other is especially apparent.

¹ Numerous sections of the tumor were furnished me by Dr. Louise Meeker.

In places, the spindle cells are arranged radially to the connective tissue septums. The stroma, as revealed by van Gieson's stain, in the central portion consists of very delicate septums, but toward the periphery becomes denser and more abundant. The blood vessels are small and few in number.

The reticulated structure of the first type of tissue is shown much more plainly in the paraffin sections than in the celloidin sections, owing to the shrinkage incident to the preparation of the former, and to the greater thickness of the latter. The tumor contains no cysts or cytoid bodies.

CASE 7.—Glioma of optic nerve, unusually large, mixed type.

The section of this case was given out as a class specimen by Dr. Wintersteiner in 1902. His diagnosis was gliosarcoma. I am unable to ascertain whether or not he reported this case, and I have no clinical data in regard to it.

Microscopic Examination.—The tumor is unusually large, measuring 24mm by 36mm in cross-section. Owing probably to the large size of the tumor, the original nerve stem can no longer be definitely recognized. The central portion of the growth, however, is essentially similar to the intraneural portion of Case 8, consisting of a vacuolated and reticulated cell syncytium with small round nuclei. In this case, however, the vacuolization is more marked, and the spaces in general are larger. The delicate trabeculae around the spaces often show fine granules on them which stain deeply in alum hematoxylin, and which are sometimes so abundant as to produce the appearance of threads or of fibrils. Toward the periphery, more and more of the cells become spindle-shaped and show coarse eosinophilic fibrils between them. Cysts filled with serum are numerous and large in size. One cyst measures 14mm by 5½mm. Cytoid bodies are extremely abundant, more so than in any of the other tumors. The blood vessels in the tumor are not numerous, but many of them are large, and many of the veins are markedly dilated. Some of the latter contain fibrinous thrombi. There are a number of large interstitial hemorrhages. At the periphery, the arachnoid in places has undergone marked proliferation, forming large strands and large masses of hyaline tissue. The latter have been invaded by the tumor in such a way as to produce areas not unlike those of a cylindroma. The dura in one place has been invaded by the tumor, but has nowhere been penetrated.

CASE 8.—Glioma of the optic nerve, mixed type.

The section, stained in hematoxylin and eosin, that I have of this case was given out as a class specimen by Dr. Salz-

man. It is evidently from the second of three tumors that he reported as myxosarcomas of the optic nerve.¹

History.—A man, aged 46, had defective vision of the left eye for twenty-five years, and no vision for four years, exophthalmos of nine months' duration, and optic atrophy. The tumor, which was incompletely removed without the globe, measured 2cm in cross diameter.

Microscopic Examination.—The section at hand, stained in hematoxylin and eosin, includes a portion of the original nerve stem. Within the nerve stem, the tumor maintains the structure of the normal neuroglia of the nerve to a remarkable degree (Fig. 8). The tissue is separated into bundles as in a normal nerve. The cells, however, are more abundant, more irregular in size, have more cytoplasm about the small round nuclei, and are highly vacuolated. They also form a more easily recognized syncytium than do the cells of a normal nerve. Some of the cells are multi-nucleated. No fibrils can be seen in relation to the cells, owing no doubt to the method of staining, but judging by the similar tissue seen in Cases 6 and 9, stained differentially for neuroglia, such fibrils are undoubtedly present. Within the intervaginal space, the character of the tumor becomes markedly altered. In large areas, the cells here show an extreme degree of vacuolization and have in places formed fairly large cysts filled with serum. Running irregularly through this portion of the tumor are numerous large bundles of spindle cells, accompanied by coarse fibrils. Judging by the similar bundles in Case 1, these are undoubtedly neuroglia fibrils. In places, there are large areas consisting almost exclusively of spindle cells, as in Case 2. Cytoid bodies are present in this tumor, but are small and few in number.

CASE 9.—*Glioma of optic nerve, mixed finely reticulated and spindle-cell type. Corpora amylacea. Hyaline necrosis. Endothelial phagocytes and giant cells* (case of Dr. Ellet's previously reported).²

The celloidin blocks of the tumor were sent to me by Dr. Ellet previous to the publication of his paper, and from these I made and stained differentially many sections. The fixation was in alcohol, which often, as in this case, permits differential neuroglia stains.

History.—A girl, negro, aged 15 years, whose right eye had protruded for five years and was blind, had an optic disk

¹ Salzman: "Studien über das Myxosarkom des Sehnerven," *Arch. f. Ophth.*, xxxix., 94, 1893.

² Ellet, E. C.: "A Primary Intradural Tumor of the Optic Nerve," *Tr. Sec. Ophth. A. M. A.*, 1916, p. 143.

which showed postneuritic atrophy on ophthalmoscopic examination. The tumor beginning about 10mm behind the globe, was incompletely removed without the globe, through a conjunctival incision. The tumor measured 3.5cm by 2.5 cm. A diagnosis of "telangiectatic glioma" was made by Dr. H. T. Brooks.

Microscopic Examination.—The tumor in spite of its large size has nowhere broken through the pia. The subdural space, however, is obliterated by compression. The appearances presented by this tumor in different places are highly varied. The different areas pass into each by more or less gradual transition. Near the cut end of the nerve, large areas of the tumor are similar to the intraneuronal portion of Case 8, consisting of a highly vacuolated delicate neuroglia syncytium with small round nuclei. The differential neuroglia stain shows an abundance of fine neuroglia fibrils running irregularly between the cells. This tissue undergoes transition into neuroglia tissue containing long coarse neuroglia fibrils running parallel to each other and generally abutting perpendicularly on the connective tissue septums. The nuclei in this tissue are still round, but are less abundant and sometimes extremely scanty. Toward the periphery this coarsely fibrillated tissue becomes more and more abundant until it greatly predominates. The fibrils in it are here not often arranged in definite bundles, but occur in irregular masses in which they have the same general directions. The nuclei are usually round, but occasionally spindle cells with oval nuclei are seen between the fibrils. In this tissue, cytoid bodies are extraordinarily abundant, and unusually large.

In places the tumor contains numerous small irregular cystic spaces filled with serum. In the central portion of the tumor there is an area of complete hyaline necrosis, about 7mm by 3mm in size, which also contains numerous calcified corpora amylacea. In the neighborhood of this area, the veins are greatly dilated and many of them contain fibrinous thrombi. There are also here interstitial hemorrhages. In the looser tissue around this area, and also in places of considerable distance from it, there are numerous endothelial phagocytes. Some of these contain red blood corpuscles, but most of them are distended with fine vacuoles, evidently left by fat droplets which have been dissolved out in the preparation of the specimens. In one place there are a considerable number of giant cells, some of them typically of the Langhan's type. These are undoubtedly not derived from the tumor cells but from the endothelial phagocytes, that is to say, they are foreign body giant cells enclosing products of necrosis. Cells in mitosis are occasionally seen,

but these also are probably not tumor cells but endothelial leucocytes. The tumor nowhere shows any infiltration with other chronic inflammatory cells. A few tumor cells containing blood pigment are to be seen.

The tumor shows one fairly large area containing numerous calcified corpora amylacea, which is decidedly different from any other portion of the tumor, and bears considerable resemblance to the white matter of a normal brain. It consists of a matrix of fine neuroglia fibrils running in various directions, in which the cells are relatively scanty. Most of the cells have small round nuclei surrounded by a small amount of cytoplasm which stains very indistinctly. These cells grade into other cells having a considerable amount of cytoplasm taking both eosin and hematoxylin stains, which contain large nuclei eccentrically placed. A few of the latter cells have long processes which give them considerable resemblance to ganglion cells. None of them show Nissl bodies, even after thionin staining, and some of them contain two nuclei. All transition forms between these cells and typical neuroglia cells can be found, so that they are undoubtedly large neuroglia cells.

The tumor nowhere contains tissue resembling that of a myxoma.

The connective tissue stroma, as revealed by Mallory's connective tissue stain, is not abundant and is confined chiefly to the walls of the blood vessels. Elastic tissue is present only within the stroma. The blood vessels are unusually abundant and large in caliber.

In front of the tumor, the arachnoid has undergone marked proliferation and produced a mass of laminated hyaline tissue. This has not been invaded by the tumor. In his brief histologic description of this case, Brooks described a constriction in the nerve. This appearance is undoubtedly an artefact resulting from the operation, due to a sharp bend in the nerve and crushing of the latter.

CASE 10.—*Glioma of optic nerve. Spindle-cell and coarsely reticulated type. Numerous cells resembling ganglion cells*¹ (case of Dr. Cohen's, previously reported).²

History.—A boy, aged 18, had had exophthalmos of long duration, without loss of ocular motility. His vision was nil. There was postneuritic atrophy. Roentgen-ray examination and Wassermann test were negative.

Krönlein operation was used in the removal of the tumor

¹ Tissue from the tumor was sent me by Dr. Louis Meeker.

² Cohen, M.: "Primary Intradural Tumor of the Orbital Portion of the Optic Nerve," ARCH. OPHTH., xlvi, 22, (Jan.) 1919.

without the globe, followed in five weeks by atrophic changes and pigmentation of the choroid and retina. The tumor was separated 6mm from the globe, and measured 2.8mm by 1.5mm.

Dr. Ewing, who examined sections of the tumor, made a diagnosis of ganglionic neuroglioma.

Microscopic Examination.—The specimen, which had been fixed in liquor formaldehydi, consists of one half of the tumor cut longitudinally and embedded in celloidin. Sections were stained in hematoxylin and eosin. No normal nerve tissue is included in the specimen. The tumor is confined to the nerve stem and has nowhere invaded the subdural space. It is composed of two types of tissue. The predominating tissue under low magnification appears to consist of a homogenous matrix which stains rather strongly in eosin and contains numerous nuclei. Careful examination under the oil immersion lens, however, shows that the matrix is composed of fibrils running in the interspaces of a cell reticulum. The cytoplasm of the cells stain so much like that of the fibrils that it is difficult to make out. Near the cut ends the tumor tissue is almost exclusively of this type and here fills the interseptal spaces of the nerve. The fibrils running in a longitudinal direction. In the central portion of the tumor, the tissue to a great extent loses its regular arrangement, and the fibrils run in various directions. The other type of tissue occurs in the form of small irregular areas within the first type of tissue, from which it is evidently formed by a process of rather abrupt transition. It consists of a cell syncytium containing large irregular spaces traversed by a few fine processes from the cells. The nuclei are generally small and round, and are surrounded by a considerable amount of cytoplasm. This tissue has some resemblance to myxomatous tissue, but the spaces contain no mucin and are apparently empty. It occurs especially near the connective tissue stroma and blood vessels, and in places seems to intermingle with the stroma. No definite cysts have been formed.

The nuclei of the first type of tissue vary greatly in size and shape. Many are small and round, others are long and oval and a considerable number are very large and round. Within this tissue, there are also many large cells with long processes which give them considerable resemblance to ganglion cells. Careful examination of these cells, however, convinces me that they are really large neuroglia cells, for they show numerous minute processes extending out into the surrounding tissue, and never contain Nissl bodies. Almost all of them show degenerative changes involving both the cytoplasm and nuclei, and the cytoplasm often shows fine vacuolization indicative of fatty degeneration.

Sometimes the nuclei display the ring formation not infrequently assumed by the nuclei of degenerated neuroglia cells of an optic nerve, which cells are probably precursors of corpora amylacea. This tumor, however, contains no definite corpora amylacea.

At the periphery of the tumor, the cells of the first type of tissue tend to become spindle-shaped and the fibrils to run longitudinally. Here a few cytid bodies are recognizable. In one place, the pia has been invaded, but not perforated, by this type of tissue, and the invading tissue contains cytid bodies in great number.

The subdural space has been obliterated by compression. The arachnoid has undergone hyperplasia to a considerable extent.

Differential Neuroglia Stain.—Sections stained directly in phosphotungstic acid hematoxylin show few if any neuroglia fibrils. In sections stained for twenty-four hours in Verhoeff's elastic tissue stain,¹ then twenty-four hours in phosphotungstic acid hematoxylin, then differentiated in a dilute solution of potassium permanganate followed by a solution of oxalic acid, neuroglia fibrils are brought out in a remarkable manner. The fibrils are abundant throughout the tissue. Most of them are large in caliber, and similar to the coarse fibrils in Case 1, but fine fibrils are also seen. The stain also brings out an unsuspected abundance of cytid bodies throughout the tumor, but they are most numerous at the periphery. Various stages in the formation of these bodies within coarse deeply staining fibrils can be easily traced. The fibrils in which they are formed cannot be traced into connection with cells, probably because by this method of staining the cells are stained very feebly. Judging by the findings in Case 1, however, it is probable that most, if not all, the neuroglia fibrils in this tumor are really cell processes. In the place where the tumor has invaded the pia, neuroglia fibrils and cytid bodies have been formed in extraordinary abundance.

CASE II.—*Glioma of optic nerve, spindle-cell type*² (case of Dr. Reese's, previously reported).³

History.—A boy, aged 5, exophthalmos had been noted

¹ Verhoeff, F. H.: "An Improved Differential Elastic Tissue Stain," *J. A. M. A.*, lvi., 1326, (May 6) 1911.

² A section of this case was sent me by Dr. James Ewing.

³ Reese, R. G.: "Successful Removal of Orbital Portion of the Optic Nerve for a Primary Intradural Tumor, with Preservation of the Eye-Ball and Mobility, by the Krönlein Method," *ARCH. OPHTH.*, xlix., 515, (Sept.) 1920.

for two years, following an injury to the right side of the head. The pupil reacted sluggishly to light. Vision could not be tested. The disk showed neuritic atrophy. Krönlein operation was performed for removal of tumor without globe, followed by neuropathic keratitis. Seven months after operation, the retinal vessels seemed pervious, and in the macular region there was marked chorioretinal atrophy with pigmentation.

The tumor measured 25mm by 13mm in diameter, and was entirely subdural. The original microscopic examination was made by Dr. James Ewing, whose diagnosis was myxoglioma.

Microscopic Examination.—The tumor is almost entirely intraneuronal and nowhere distends the subdural space. One end of the specimen contains a portion of uninvolved nerve, the other end does not, so that the removal of the tumor was incomplete. In structure, the tumor is of the spindle-cell type, identical with that of Case 2. As in the latter case, there is gradual transition of the neuroglia of the uninvolved nerve stem into that of the tumor. Small cystic spaces are present but are few in number. Cytoid bodies can be seen, but with difficulty, owing to the thickness of the section and the feeble eosin staining. The subdural space has for the most part been obliterated by compression, but in places is filled with proliferated arachnoid tissue. The pia has been invaded by the growth which in places has also begun to extend into the dura.

(*To be concluded in May number.*)

NON-SURGICAL TREATMENT OF MALIGNANT EPIBULBAR NEOPLASMS.¹

BY DR. EDWARD B. HECKEL, PITTSBURGH, PA.

(*With seven illustrations on Text-Plates XI. and XII.*)

WHILE malignant epibulbar neoplasms are not common, yet they are so important that they should command our closest study. Prior to the advent of the Roentgen-ray and radium, surgery offered the only means of treatment. The usual procedure was: an excision of the neoplasm and in most, if not all, of the cases a rapid return of the growth, followed later by an enucleation and not infrequently by a total exenteration of the orbit and as a rule all without control of the malignancy. It may be good surgery to excise all malignant growths provided they can be excised completely and the cutting procedure limited to the surrounding tissue. It goes without saying that epibulbar neoplasms do not provide these conditions. The space is limited and all the tissue valuable, none should be sacrificed. The principal commandment of the cancer decalogue is "do not cut across a cancer and leave a part behind. The part remaining will grow more rapidly than if it had been let alone altogether." Malignant tissue is of an embryonic type and therefore especially vulnerable to Roentgen-ray and radium so that we may reasonably say that Roentgen-ray and radium produce a selective necrosis of malignant tissue.

Prior to 1910 our results in the treatment of these cases with the Roentgen-ray were not very flattering, especially as to the

¹ Read before the Twenty-Sixth Annual Meeting of the American Academy of Ophthalmology and Oto-Laryngology, Wednesday, October 19, 1921, Philadelphia, Pa.

preservation of a functioning eye. Most of these cases resulted in a sloughing of the cornea as a result of drying due to long exposure under the Roentgen-ray.

At the meeting of our Academy in Chicago in 1915 it was the writer's privilege to report a case of epibulbar sarcoma, treated with Roentgen-ray in 1910, with a technique which resulted in a complete cure of the malignancy and the preservation of a perfectly functioning eyeball. The success in this case was, the writer believes, the result of keeping the anterior segment of the eyeball wet during the exposure to the Roentgen-ray, by the continuous dropping of a normal salt solution over the eyeball. Since then we have been able to discard the salt solution, due to better and more efficient X-ray tubes. The technique employed in the following cases consisted of placing the patient in a recumbent, comfortable position, the face was covered with a piece of tin foil, perforated with a small hole a little larger than the neoplasm and so placed that when the patient was directed to look in a certain direction the aperture in the tin foil was directly over the neoplasm. This procedure permits the patient the free use of the eyelids so that he may wink as often as he desires; in this manner the cornea is kept moist and cannot dry.

CASE 1.—A. L. R., aged 71 years. Referred by Dr. McMurray of Washington, Pa. Patient first noticed "a small lump," on his right eye about one year ago; it had been growing gradually till it represented the appearance shown in Fig. 1. The eyes were negative in every other respect. R.V. = $\frac{2}{3}$; with + 2.25 D.S., L.V. = $\frac{3}{4}$; with + 1.00 D.S. \cap + 0.50 D.C. ax. 60°. A small piece of the neoplasm was excised and examined by Dr. Haythorn of the Singer Memorial Research Laboratory of the Allegheny General Hospital with the following result:

"Section from the corneoscleral junction. Serial sections were made through the whole piece of the tissue removed. A bit of sclera shows an intense infiltration with plasma cells. The portion nearest the cornea contains several papillary outgrowths with well developed epithelial pearls. The cells near the lower portion of the epithelial layer are atypical, picnotic, and show well developed intercellular ridges. At the end nearest the cornea the cells show atypical arrangement with the formation of concentric epithelial bodies in their lowermost layer. As no stroma is present

beneath the layer it is impossible to say whether actual invasion has taken place or not."

Diagnosis: Epidermoid carcinoma. See Fig. 2 and Fig. 3.

The Roentgen-ray was applied by Dr. G. W. Grier as follows: First application over the lesion as above described was made with 5 M.A. current at a voltage corresponding to 6½ inch parallel spark gap; the distance from anode of tube to lesion was 8 inches; no filter of any kind was used. This current was applied for 2½ minutes. *Second exposure*, five days later, the same treatment was applied. *Third exposure*, three days later, the same treatment was applied except that the exposure was three minutes long instead of 2½ minutes. *Fourth exposure*, four days later, the same treatment as that of third. After this series of treatments the patient was given a rest of twenty-one days. At the end of this time there was still a small part of the growth remaining. Treatment was then again resumed (*fifth exposure*) twenty-four days after the fourth exposure; the same technique was used except that this time the tube was 10 inches from the lesion and the length of treatment was extended to 3½ minutes. *Sixth exposure*, three days later; he was given a similar treatment at 10 inches distance; the length of treatment was three minutes. *Seventh exposure*, two days later; he was given the same treatment as the fifth exposure. One month later the lesion had completely disappeared and remains so. See Fig. 6.

CASE 2.—G. W. S., aged 61 years. Patient first noticed "a small lump" on the right eyeball about six months ago; growth quite rapid within the last four or five weeks, when it presented the appearance shown in Fig. 4. Otherwise the eyes were negative. R.V. = $\frac{2}{3}$; L.V. = $\frac{2}{3}$. A piece of the neoplasm was excised and examined by Dr. Alter of the Western Pennsylvania Hospital with the following result:

"Specimen consists of small nodule 3mm in diameter. It is quite firm. Section of the small nodule shows irregular proliferation over the surface epithelium and covered with hemorrhage. The section is diagonal and the nature of the invasion is not very clear.

"Diagnosis: Squamous cell carcinoma." See Fig. 5.

Dr. G. W. Grier applied the Roentgen-ray as outlined above: First application over the lesion as above described was made with 5 M.A. current at a voltage corresponding to parallel spark gap of 6½ inches; the distance from the lesion to the anode on the tube was 9½ inches, no filter of any kind was used. The exposure lasted 3½ minutes. *Second exposure*, two days later, under the same conditions. *Third exposure*, four days later, same technique. *Fourth exposure*, two days later, same technique. Patient

was then given a rest for nineteen days and as some of the neoplasm remained he was given the *fifth exposure*, with same technique, except that the time was extended to four minutes. *Sixth exposure*, three days later, same technique. *Seventh exposure*, four days later, same technique. *Eighth exposure*, two days later, same technique. After this the patient was given a rest for twenty-three days, when the lesion had almost disappeared, but as some remained he was given the *ninth exposure*, with the same technique. *Tenth exposure*, two days later, the *eleventh exposure*, two days later and three days later the *twelfth exposure*. All trace of the neoplasm has now disappeared. See Fig. 7.

Summary of treatment of the first case, total exposures, seven, time consumed, thirty-five days.

Summary of treatment of the second case, total exposures, twelve, time consumed, seventy days.

While the results in the reported cases by the writer are all that could be desired and therefore surgical interference not justified in similar cases, he is not unmindful of neglected cases where the neoplasm projects through the lid aperture as a cauliflower growth; in such cases it would be well to excise the protruding mass with the actual cautery or electro-cautery heated to a cherry red heat, and then follow this immediately with Roentgen-ray or radium.

CYSTS AND CYSTIC TUMORS OF THE CARUNCLE: WITH SPECIAL REFERENCE TO SEBACEOUS CYSTS.

BY DR. JOHN GREEN, JR., ST. LOUIS, Mo.

THE ocular caruncle is a small, reddish, nipple-like prominence situated to the inner side of the semilunar fold, and occupying the bottom of a horseshoe-shaped excavation at the inner angle of the eye. Histologically, it is, in the words of Fuchs, "A small island of skin containing sebaceous glands, sweat glands, and small glands like Krause's glands and having its surface covered with small light colored hairs."

Although its structure identifies it as an appendage of the skin, most textbook writers discuss its diseases and abnormalities in the chapter devoted to the conjunctiva, probably for the reason that situated as it is in close proximity to the conjunctiva, it is often affected secondarily to inflammations of this membrane.

A swollen and congested caruncle may be one of the signs of eye strain, especially "in cases of imperfect amplitude of convergence" (Weeks). For this condition de Schweinitz has suggested the name of "symptomatic or functional encanthus."

New growths of the caruncle are exceedingly rare. For example, among 60,000 eye patients, Waetzold (1) saw only six examples of neoplasm of the caruncle, of which three were congenital.

Beauvieux's (2) classification of tumors of the caruncle is as follows:

Tumors of Epithelial Origin.

- A. Benign
 - Adenoma
 - Papilloma

Papillomatous polyps
Granuloma
Cysts

B. Malignant
Epithelioma
Carcinoma

Tumors of Conjunctival Origin.

A. Benign
Fibroma
Hyaline Tumor
Angioma
Lymphangioma
Lymphoma

B. Malignant
Sarcoma
Lymphosarcoma
Melanosarcoma

Mixed Types.

Simple Hypertrophy
Papillary Hypertrophy
Telangiectatic Fibroma
Lipodermoid
Dermoid Cysts.

Although cysts originating from the conjunctiva are not very rare, there have been only a few reports of cases in which the cyst originated from the caruncle or semilunar fold. The present communication is concerned solely with cysts and cystic tumors of the caruncle.

One of the earliest reports of dermoid cyst of the caruncle was made by Berl (3). The caruncle, large at birth, began to grow slowly when the patient was twenty years of age. Twenty years later it measured $10 \times 9 \times 8\text{mm}$ and was then excised. The external surface, desiccated in consequence of exposure in the palpebral aperture, was covered with pavement epithelium. Underneath was dense connective tissue containing hair follicles and sebaceous glands and deeper still loose connective tissue traversed by blood vessels. Within was a well defined cyst which contained hair follicles and hair fragments.

Cysts originating from the modified sweat glands of the

caruncle have been described by Piccoli (4) and Rumschewitsch (5).

Piccoli's patient was a marble worker who had a chronic trachoma, with its usual accompaniments (blepharophimosis, entropion, etc.). Following a slight trauma in the region of the internal angle, a smooth yellow nodule developed in the center of the hypertrophied semilunar fold. The growth proved to be a cyst containing disintegrated red blood cells and pigment. Its wall was covered with several layers of flattened epithelial cells.

Rumschewitsch's first case concerned a man with chronic trachoma. For two years a tumor had been growing from the caruncle. At the time of operation, the pear-shaped tumor was 1cm in diameter, pedciled, translucent, of a pale pink tint. Examination showed the surface composed of layers of cylindrical and flattened epithelium, the outer layers being distinctly cornified. Beneath the epithelium lay dense connective tissue traversed by numerous dilated blood vessels and infiltrated with lymphoid cells. Sebaceous glands and hair follicles were situated in the lower anterior part of the tumor. The upper part contained cavities, the epithelial lining of which showed signs of mucoid degeneration. In the lower posterior portion formations apparently representing longitudinal and transverse sections of gland follicles could be observed. These formations consisted of many layers of epithelium surrounded by lymphoid infiltration. These glandular ducts (modified sweat glands) had participated in the formation of cysts, which had formed as a result of obstruction of the ducts and dilatation of the lumina.

Rumschewitsch's second case concerned a 26-year-old patient from whom he had removed the transition folds on account of hyaline degeneration of the conjunctiva. Two years later he discovered a translucent tumor, of pale rose color with vertical diameter of 1.5cm occupying the upper portion of the fold. The posterior portion of the tumor was connected with the underlying tissue. Examination of the growth showed that it contained a large cavity, which was divided by a septum into an upper, larger, and a lower, smaller, part. The cyst wall revealed conditions analogous to those observed in the first case. Changes (inflammatory and

degenerative) in the epithelium of the glandular ducts likely to give rise to an obstruction of the ducts and cystic degeneration were observed.

Adenomata of the caruncle are rare. They may or may not present minute cysts in the body of the tumor. A typical example of cystic adenoma is described by Prudden (6). In a woman of seventy-four a reddish, soft, globular tumor, $4 \times 5\text{mm}$, had been growing from the inner canthus of the left eye for seven years. It was encapsulated and spongy. The spongy portion consisted of tubular branching structures with central lumina, lined with cuboidal and cylindrical epithelium. The amount of stroma was small, some of the tubules were cystic, some empty, some contained granular material and disintegrating cells. In the surrounding tissues, sections of sweat glands were found. The surface lining had the character of the caruncular epithelium.

Testelin (7) observed a tumor of the caruncle in a girl of 18 years. It was located at the superior and external portion of the caruncle and invaded the semilunar fold and bulbar conjunctiva almost to the cornea. It was the size of a large pea, slightly flattened and lobulated, firm, yellowish gray, not adherent to the sclera. Microscopically it was formed of glandular cul-de-sacs of the same structure as the normal glands, but larger and in greater numbers. It was probably a sebaceous adenoma.

As is well known sebaceous cysts may occur in the skin of the lids as in other parts of the body. Tiny retention cysts of sebaceous glands—*milia*—are frequently found in the skin of the lids.

Parsons (8) states that the sebaceous glands of the caruncle "may be affected with diseases common to them elsewhere, e.g. acne: and concretions may form in them from retained secretions becoming impregnated with calcium salts." In view of this statement, it is indeed surprising that one of the common affections of sebaceous glands, e.g. sebaceous cysts, should not be frequently met with in the caruncle and yet a careful personal search of the literature supplemented by an investigation by the Research Department of the American College of Surgeons has yielded only a single report of an example of this type of cyst. I cannot believe that these cases

are so excessively rare as the paucity of published cases would lead us to assume. As they give rise to little or no discomfort, patients who harbor them are not prone to consult an oculist (in my case, the patient came merely because of asthenopic symptoms). Probably, also, many examples have not been reported, as surgeons may have assumed, as I did before I began to look up the literature, that they are not uncommon.

CASE REPORT.

Miss B. P. W., age 38 years, colored, consulted me July 28, 1921, complaining of rather vague asthenopia. During the routine examination, I discovered that the left caruncle projected 1.5mm in front of the palpebral aperture. On examination with the binocular loup I observed a yellowish mass apparently situated just underneath the skin of the caruncle. The growth was slightly elastic to palpation, was smooth and ovoid, with the long diameter (about 3mm) horizontal. The caruncular skin seemed to be firmly adherent to the mass. The appearance and "feel" of the little tumor was precisely that which we so often find in sebaceous tumors of the lids and vicinity and I had no hesitancy in making a diagnosis of sebaceous cyst.

Under novocain infiltration, I made a horizontal incision through the superficial layers of the caruncle and at once came upon the yellow, tense, glistening cyst wall. The caruncular skin was adherent throughout, so that careful blunt dissection was required. Just as I was making the last few snips with the scissors in freeing the cyst from the underlying tissue, it ruptured anteriorly and a small quantity of yellow, homogeneous, smooth, soft, cheesy material oozed out. On the appearance of this material, so perfectly typical of the contents of cutaneous sebaceous cysts, all doubts as to the diagnosis were dissipated from my mind. The specimen was submitted to Dr. Downey L. Harris, the pathologist, who reported as follows:

"The specimen from B. W. is a yellowish white oval mass 2 X 3mm with a smooth fibrous exterior. Sections through the tissue show it to be a smooth thin-walled cyst with soft cheesy contents. No hairs were found in the cyst. Microscopical examination shows the cyst to be lined with one or more layers of flat or cuboidal cells. These cells have a deeply-staining oval nucleus with a relatively small amount of protoplasm."

"*Diagnosis.—Retention cyst (sebaceous cyst).*"

The only case in the literature similar to the above is that reported by Steiner (9).

Female, European, 72 years, complained of epiphora and blindness of the right eye. This eye is blind from cataract. On the lower temporal aspect of the caruncle is a yellow white, egg-shaped tumor $3 \times 2\text{mm}$. This lies just underneath the surface of the caruncle, is sharply circumscribed, movable, and has a smooth surface. The pressure of the tumor has displaced the lower punctum, accounting for the epiphora. The tear duct is not occluded. The little tumor, with a narrow strip of conjunctiva and half of the caruncle, was removed.

The tumor consisted of a cyst lying immediately under the surface and separated from it by a narrow layer of connective tissue. The cyst wall was sharply defined, thin, and fragile. Through the action of ether and alcohol used in fixation, the contents had almost entirely disappeared, but in some places detritus (fat?) was still visible. The cyst wall presented several layers of epithelial cells and a distinct membrana propria. The epithelial cells were small, cuboid, stained well, and corresponded to the epithelial cells of sebaceous glands. Where the epithelium was thicker, drops of secretion could be detected in the protoplasm of the centrally located cells. Two or three layers of epithelial cells lined the periphery.

Normal sebaceous glands could be seen in the immediate neighborhood of the cyst. Some of the glandular cul-de-sacs contiguous to the cyst were flattened. At one place there was a direct connection between the epithelium of the cyst and that of a neighboring sebaceous gland, at which site the membrana propria was missing. Here and there were found little collections of round cells.

Diagnosis.—Retention cyst of a sebaceous gland (resembling a milium).

The differential diagnosis should offer no difficulties. The possibility of a dermoid or a cyst developing from the modified sweat glands should be borne in mind.

REFERENCES

1. WAETZOLD. *Centr. f. prakt. Augenh.*, vol. xxxvii., p. 42.
2. BEAUVIEUX. *Archiv d'Ophthalm.*, 1913, xxxiii., 216.
3. BERL. *Deutschmann's Beitr.*, Heft xlvi., p. 62.
4. PICCOLI. *Lavori del Clinica d. Univ. di Napoli*, xii.

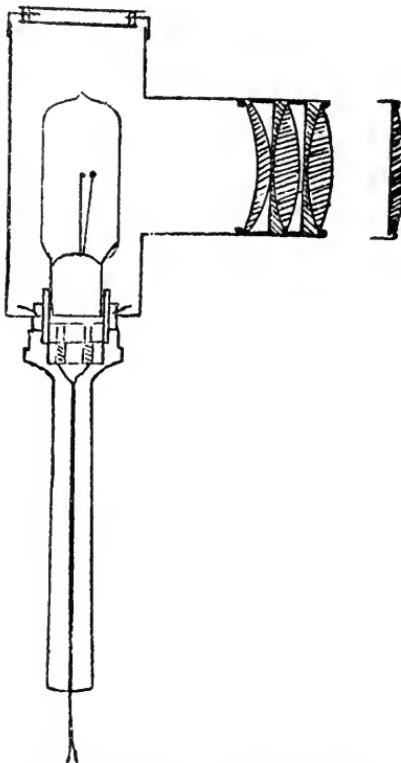
- 5 RUMSCHEWITSCH. *Kl. Monatsbl. f. Augenh.*, 1903, p. 24.
- 6 PRUDDEN. *Arch. of Ophthalm.*, 1886, xv., 1.
- 7 TESTELIN. *Dict. Encycl. des sc. med.*, 1871, vol. xii., 615.
- 8 PARSONS. *Path. of the Eye*, vol. i., 1904, p. 146.
- 9 STEINER. *Centr. f. prakt. Augenh.*, 1910, xxxiv., 161.

AN OPERATING HAND LAMP FOR OPHTHALMIC WORK.

By DR. A. MAITLAND RAMSAY, GLASGOW.

(*With one illustration in the text.*)

FOR several months I have been using a hand lamp in which the source of illumination is the "pointolite" electric lamp of the Ediswan Co., and as I have been so satisfied



Hand Lamp for Ophthalmic Work.

with it in all operations on the eye, I venture to bring it to the notice of ophthalmic surgeons. The lamp is of 30 candle

power and is enclosed in a metal case with an aperture on one side in which a system of achromatic lenses is so fixed that the emergent rays are parallel. By this means the field of operation is evenly illuminated by a disk of light free from all shadows. A resistance is supplied with each lamp, whereby it can be used with a direct current from the main of any voltage between 100 and 250, and a special lamp can be got to work on any direct current down to 32 volts. Up to the present, however, a lamp has not been constructed for an alternating current. A convex auxiliary lens of 3 diopters can be adjusted in front of the fixed lens in order to bring the light to a focus. An opaque capsule after cataract extraction, no matter how thin it may be, is thereby brought so clearly into view that capsulotomy operations can be performed with great precision. The lamp can be used for a considerable length of time without any inconvenience from heating. It is made by John Trotter, Ltd., 40 Gordon Street, Glasgow.

TRIFOCALS MINUS WAFERS.¹

By TALBOT R. CHAMBERS, F.A.C.S., JERSEY CITY, N. J.

(*With one illustration in the text.*)

SINCE presbyopes must wear glasses, they should be as inconspicuous and efficient as possible. The lens without pasters is inconspicuous and the trifocal is far ahead of the bifocal for efficiency.

There are presbyopes who claim inability to use bifocals. Such would not be interested in trifocals.

The trifocal offers a larger field for near work and avoids the necessity for changing glasses for distances between 14" and 50".

It has its limits. The external field of far vision is lessened by reason of the interference of the intermediary. This is its chief insufficiency but after some days of constant use the wearer acquires confidence and facility.

They are recommended for the surgeon, oculist, musician, librarian, bookkeeper, engineer, mechanician, especially the card player and automobile driver.

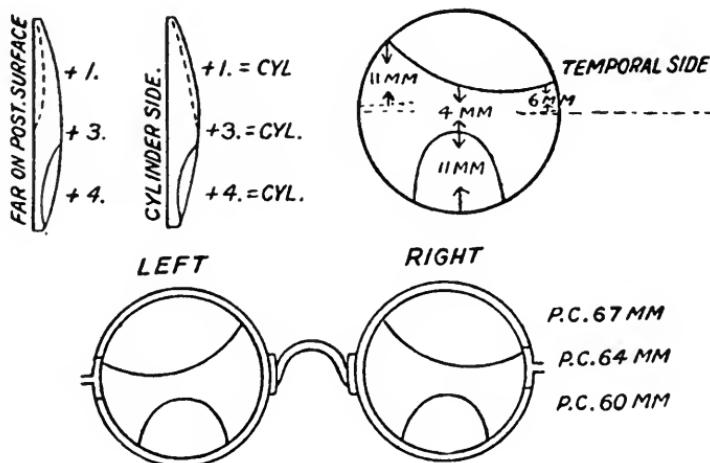
It goes without saying, that the refraction error must be accurately corrected and the adjustment right. Caution must be taken that the lens cannot revolve in its frame. This is managed by making the frame elliptical instead of circular.

An individual needs +1 for far; +3 for intermediary and +4 for reading.

The most satisfactory result is obtained from a kryptok slab of crown and flint glass, the crown being +3. and the flint +4.

¹ Read before the Eye Section, New York Academy of Medicine, Nov. 21, 1921.

If astigmatism needs correction, the cylinder is ground on the posterior surface of the slab. For the individual needing +1 for distance, the +1 is ground on the anterior surface if the posterior is taken for the cylinder. If there be no cylinder



the +1 is ground on the posterior surface. In either case it is ground so that about 4mm is left for intermediary (+3). In order to get a larger field on the temporal side it must be ground as in cut, so that there is not more than 6mm of intermediary above center on temporal edge of lens.

In sample shown, the pupillary center for the far was 67mm; for the intermediary 64mm; and for the near 60mm. Of course these centers must be according to the individual needs.

Toric lenses, all will agree, are more suitable for presbyopes and trifocals are no exception.

Discussion.—Dr. J. H. Clairborne stated trifocals are not new but the arrangement here suggested contains new ideas which if practical have value.

In reply to questions. The cost would probably be half more than that of the ordinary bifocal kryptok. The lens could only be made by a high grade mechanic and it is necessary to employ a cemented wafer for protection during the grinding and this thrown away on completion of the job.

There is no chromatic nor prismatic aberration as was proven by sample displayed.

REMARKS ON DR. C. KOLLER'S PAPER, "THE PHYSIOLOGICAL MODE OF ACTION OF MYDRIATICS AND MIOTICS—EXPLAINING THEIR EFFECT IN HYPERTENSION (GLAUCOMA)."

BY DR. MARK J. SCHOENBERG, NEW YORK.

ON rare occasions a paper appears in the ophthalmological literature which by virtue of its contents or its author or both commands our special attention. Undoubtedly there is no subject in which we are more keenly interested than glaucoma and no name more illustrious and better entitled to a respectful hearing than that of Dr. Carl Koller. The suggestions and conclusions contained in his paper are of great interest but contradict a number of facts established by physiological, pharmacological, and clinical observations. May we be allowed to discuss some of the salient points brought out by this paper.

The predominating ideas in Dr. Koller's paper are:

1. That "for the habitual width of the pupil the state of fullness of the iris vessels is the determining factor."
2. That "mydriatics slow up circulation by producing anæmia through the constriction of small arteries, whereas myotics by dilating the small arteries speed up circulation and thus favor the absorption of abnormal quantities of transuded serum."
3. That "in acute glaucomatous attacks the circulation is slowed up and stagnant and that mydriatics slow up circulation whereas myotics speed it up, these adverse, respectively favorable effects becoming intelligible."

Let us analyze the facts on which Dr. Koller's conclusions are based.

- A. Dr. Koller explains the small size of the pupil in con-

gestion of the iris and the widely dilated pupil after death by the apparently simple fact that the iris blood vessels are full in the first and empty in the second condition. Is this explanation really sufficient? Death is followed by general relaxation of all the sphincters in the body, caused by the cessation of the normal innervation of these sphincters which keeps up their continuous tonus. The relaxation of the sphincters of the urinary bladder and of the anus after death, are they due to the emptiness of blood vessels in these respective regions? The same line of arguing is applicable to the dilatation of the pupil after an animal is bled to death; the vascular emptiness in the iris may have something to do with the phenomenon, but the main factor is identical to that causing relaxation of the sphincters in other parts of the body (the cessation of the tonic innervation of the sphincters of the pupil after death).

The contraction of the pupil in a congested iris no doubt is due to the state of fullness of the blood vessels, but who can deny that the nerve fibers of the sphincter are also stimulated by this congestive state?

B. "An injection of methylen blue in the aorta under pressure is followed by immediate very marked myosis." This experiment is brought forth as a proof that the pupil can be narrowed by simply filling the iris blood vessels. While this experiment seems conclusive its author does not state whether the amount of pressure used in injecting the aorta was excessive and thereby results were obtained under circumstances entirely outside of physiological conditions.

C. The fact "that all states of cerebral congestion go with narrow pupils (sleep, morphinism and meningitic coma) whereas all states of cerebral anaemia (syncope, epileptic seizure) go with wide pupils" does not, to my mind, prove that the size of the pupils is necessarily due to the state of fullness of the iris blood vessels in these conditions.

In the first place it is questionable whether the brain is congested during sleep and anaemic during an epileptic attack. Then, the congestion and anaemia of the iris have not been demonstrated yet by an actual study with the corneal microscope in patients with cerebral hyperaemia and anaemia. Furthermore if there is any tissue the blood vessels of which

should reflect the state of fullness of the cerebral blood vessels, it is certainly the retina and not the uvea. Do the retinal blood vessels invariably act like the mirror of a vascular state of congestion or anaemia in the brain or meninges? And if not how can we expect the uveal circulation to do this? In intracranial congestive states where there is so much occasion for the stimulation of the pupillo-motor nuclei or of the nerve fibers in their course to the eyeball, we can easily explain the contraction of the pupil. In anaemic conditions of the intracranial contents the partial or total cessation of tonus innervation of all the sphincters in the body including the sphincter pupillæ (involuntary defecation, urination) is sufficient to explain the pupillary dilatation.

Nobody denies that pupils can be widened by emptying the iris blood vessels and narrowed by filling them, but so far the facts brought forth do not prove that the state of fullness of the iris vessels is the main determining factor of the size of the pupil. They do not exclude the very plausible probability that the main determining factor of the pupillary size in normal individuals is the state of balance between the innervation of the two antagonistic muscles in the iris (sphincter and dilator).

D. *Atropine*.—Has atropine a local vaso constrictive action? The paper under discussion says yes and brings forth as proofs:

- a. The disappearance of the ciliary congestion in iritis when treated with atropine.
- b. The shrunken mucosa of the nose and the blanching of the pharynx following an overdose of atropine by instillation.
 - (a) But atropine blanches the eye in iritis because it puts the iris and ciliary body at rest. Congestion is increased in inflamed organs when they are kept active and it is markedly reduced when they are put to rest. That is why rest is the first rule in the treatment of an inflamed organ. If atropine has a local vaso-constrictive effect why does it not blanch normal eyes without errors of refraction? Why does it produce redness when applied on the skin? Why do blood vessels of an isolated intestinal loop, transfused with a fluid containing atropine, dilate?
 - (b) An overdose of atropine instillations in the eye gives a shrunken nasal mucosa and blanched pharynx not by produc-

ing vaso-constriction but only after it has been absorbed into the general circulation, by action upon the medulla and upon the secretory glands (cessation of glandular secretion in nose and throat).

E. *Cocaine.* According to Dr. Koller, cocaine dilates the pupil and causes the widening of the palpebral fissure solely or mainly by shrinking the blood vessels in the iris and in the lids. "Inject cocaine in a certain point under the conjunctiva, near the cornea, and the iris will shrink in that very meridian in which the injection was made, the pupil becoming eccentrically pear shaped." It is difficult to understand why this fact should be considered proof that the cocaine acted by shrinking the blood vessels only in this meridian and not by stimulating the sympathetic filament innervating that particular group of dilator fibers. Cocaine is both a vaso-constrictor and stimulator of the dilator pupillæ. If its main pupillo-dilator mode of action is by shrinking the iris blood vessels why does cocaine fail to dilate the pupil in patients with a Horner syndrom?

F. The fact that Adrenaline dilates a sector of the pupil, like cocaine, when injected under the conjunctiva, is not stronger evidence that its action is solely or mainly vascular. Adrenaline is a stimulator of the sympathetic system par excellence; it contracts only such blood vessels which have sympathetic (vaso motor) fibers in their walls; it has no effect upon the blood vessels in the lungs, liver, brain, and heart which do not contain sympathetic fibers. Why attribute pupillary dilatation only to its vaso-constrictor properties and not to its action on the dilator pupillæ? Furthermore, repeated instillations of adrenaline produce a dilatation of the pupil in a very large majority of glaucomatous eyes (Knapp's observation), but not in normal eyes. Is this curious response in glaucoma due to a hyper-sensibility of the iris blood vessels or to the hyper-sensibility of the vaso-dilator sympathetic fibers? An unequivocal answer to this question may be decisive as to the correctness of Dr. Koller's conception. If we would know of a drug which has the property of acting only upon the blood vessel wall but not upon the sympathetic we could make use of it in testing out the agents determining the dilatability of the pupil. Adrenaline is not such a drug because its action is solely on the sympathetic and with the best good-

will there is no way of telling whether the dilatation of the pupil, after a subconjunctival injection of adrenaline, is due to the stimulation of the dilator or to the constriction of the iris blood vessels or both. But pituitrin has the remarkable quality of contracting the smooth muscle fibers in the blood vessels walls. This substance does not act upon the smooth muscles via sympathetic; it produces vaso-constriction even in tissues void of sympathetic innervation. Injected intra-dermally it produces a white patch of ischemia, just as intensely white as the adrenaline, but it causes whiteness by acting directly upon the muscles of the blood vessels, while the adrenaline acts by stimulating the sympathetic nerve endings in the muscle fibers. Now, what is pituitrin's effect upon the pupil? We would expect that if the size of the pupil is determined by the state of fullness of the iris blood vessels, pituitrin, which is a vaso-constrictor par excellence should produce at least as much a pupillary dilatation as adrenaline. The following experiment speaks for itself. Inject one drop of adrenaline under the conjunctiva of one eye and one drop of pituitrin under the conjunctiva of the other eye of the same patient. The pupil in the adrenaline eye dilates about $2/3$ times more than that in the pituitrin eye. Does this mean that the state of fullness of the iris blood vessels is the main factor determining the pupillary width?

G. *Action of Myotics.* If myotics are vaso-dilators when instilled in the eye, why do they blanch sometimes congested glaucomatous eyes? Pharmacology teaches that eserin produces *vaso-constriction* when present in a perfusing fluid passing through the blood vessels of an isolated intestinal loop or even through the lungs. Furthermore the following classical experiment is very suggestive. Placing a frog's eye in a 1% solution of pilocarpine in the dark, the pupil readily contracts. Since it is improbable that the pilocarpine produces vaso-constriction in an exsanguinated, enucleated eye, its action is to be placed on the nerve terminals in the sphincter pupillæ.

The transitory pupillo-constrictor effect of dionin could just as well be attributed to a sensory reflex (pupillary contraction caused by irritation of the cornea). A foreign body or an abrasion of the cornea will contract the pupil very readily. If dionin contracts the pupil not by the pain it

causes, but by vaso-dilatation, why does it not act on the pupil, if applied after a thorough holocainization of the cornea?

The entire question herein discussed would be of microscopic importance if it would not directly concern the problem of glaucoma. It is the acceptance of the application of some of Dr. Koller's ideas to glaucoma that seems most difficult.

"The circulation in an eye with a mild attack of acute glaucoma is sluggish. The pupil is widened and irregular; *this bespeaks constriction of arteries* (italics mine). The arteries of the iris and probably all ciliary arteries are constricted, carrying but little blood, whereas the veins are widened and gorged which means that the whole circulation is stagnant." It is difficult to see how an engorgement of the veins can exist if the arteries are constricted. Taking for granted this unusual possibility how does it happen that the venous engorgement does not disappear spontaneously? Nobody so far has ever pretended that the circulation in the veins is completely stopped. As the veins empty and the narrow arteries drive very little blood towards the veins, there ought to result in glaucoma, according to Dr. Koller's idea, a complete ischæmia. The wide and irregular pupil in glaucoma, is the result of several factors (paralysis of the parasympathetic fibers or stimulation of the sympathetic fibers or both) but surely not to the iris ischæmia alone. "If circulation is impaired, stagnant in glaucoma (nobody can deny this) and if mydriatics slow up circulation, whereas myotics speed it up, these adverse respectively favorable effects become intelligible." This explanation, if well founded, would certainly be a most welcome addition to our store of Ophthalmological knowledge, but in view of the preceding remarks, it can not be accepted without hesitancy. It is not the intention of these remarks to discuss the nature or ætiology of glaucoma. We shall hear about this subject comparatively soon. The following sentences agree better with the teachings of physiology, pharmacology, and clinical experience.

1. The habitual width of the pupil is determined mainly by the state of balance between the intensity of innervation of the two antagonists (sphincter and dilator).

2. Clinical observation does not prove that mydriatics produce an appreciable vaso-constriction in the uvea, and

thereby a slowing up of the circulation, neither that myotics produce a vaso-dilatation and thereby a speeding up of the circulation.

3. The adverse, respectively favorable effects of mydriatics and myotics on glaucomatous eyes is due to their various actions on the sympathetic and parasympathetic nerve endings in the ocular tissues.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

BY MR. H. DICKINSON, LONDON.

An ordinary meeting of the Section was held on November 11th, SIR WILLIAM LISTER occupying the chair.

Cases: Mr. HUMPHREY NEAME showed three interesting cases. The first was one of **cyst of Krause's gland**. He did not feel quite sure of the diagnosis, as those glands were not so common in the lower fornix as in the upper.

His second case was that of a lad aged 16 who had **papular formations of the upper lid**. He had noticed nothing amiss until the beginning of October, when there was marked swelling of both upper and lower lids, and some swelling and tenderness of pre-auricular glands. The conjunctival secretion showed no eosinophiles, and the section showed only a zone of round-celled infiltration, not sufficient to account for the papular formation. The character of the case would be settled on the histological evidence.

The third patient he showed had **tuberculosis of the conjunctiva**. The boy went for a holiday last year 40 miles away, going down by cycle, and at the end of the journey he was very exhausted. After returning to work, while stooping down, he felt something "go" in the left eye, and from that day the sight of the eye had gradually failed, so that in 6 weeks he could do no more than perceive a hand close in front of him. In September, 1920, he noticed swellings in the neck, and in March this year a cough started, and watering of the eye previously sound (the right). Sent to a tuberculosis hospital the diagnosis made was Hodgkin's disease; there were no signs of tubercle in the chest, and no tubercle bacilli were

found in the sputum. He had lost a stone in weight in a year, but there had been no appreciable loss during the last three months. Four months ago he was admitted to Moorfields with iridocyclitis of the left eye; there was a hazy cornea, and the anterior chamber was full of a whitish substance. The eye was excised. A section of it was shown. The anterior chamber was filled with cellular and fibrous material, and iris and ciliary body were practically destroyed. Last month a part of the conjunctiva of the right eye was excised, and that showed a fairly typical tubercle formation. Two small glands from behind the ear were excised, and the material crushed and given to a guinea pig, but beyond a local reaction it produced no definite illness. The glands showed marked fibrous tissue formation, indicating that the process must have been very chronic.

Mr. MAYOU and Mr. HARRISON BUTLER thought it likely that the cyst case was spring catarrh, and advocated a further test for eosinophilia.

Mr. LINDSAY REA exhibited a case showing the result of a Pouillard operation for ptosis, and one of **angioma of the retina**. With regard to the case of angioma, he referred to the similar case examined by Mr. Collins and described in the Ophthalmological Society's *Transactions* in 1892 and 1894. In the present case there was a large white mass over the macular area, and a large vein ran down the disk. The growth appeared to be pushing the retina in front of it.

With regard to the case of ptosis, he chose the Pouillard operation in preference to a Motet, because it was then all in front of one, and one could see exactly how much to open the eye.

The CHAIRMAN, speaking of the angioma case, said this condition must be of great rarity. The white masses in the fundus in this case must be decolorized blood-clot, which was being gradually absorbed, like the "melting-snow" variety seen in cases of large sub-choroidal hemorrhage. As to the case of ptosis, he pointed out the difficulty of evertting the lid after a Motet operation if a foreign body got into the eye. He himself favored the Hesse operation for ptosis.

Mr. TREACHER COLLINS did not consider angioma of the retina such a very rare condition; he spoke of several cases he had seen. With regard to the ptosis case, he preferred the

Motet to the Poulard operation; he had done the former three times, and the results pleased him greatly. The present patient could not completely close his eye, so that it was probably open during sleep; but with a Motet complete closure was ensured during sleep.

Mr. R. G. DOYNE exhibited a case of **congenital malformation** of iris and anterior chamber. The iris showed an absence of anterior layers in many places, and there was a hole in each eye through which the red reflex could be obtained. In the left eye the fibers of the suspensory ligament could be seen. Also the angle of the anterior chamber was malformed and appeared to be filled with whitish substance, and strands could be seen running from the posterior surface of the sclero-corneal junction to the anterior surface of the iris, and the margin of the cornea was opaque. The child was highly-strung, but not particularly backward.

The CHAIRMAN referred to a case he once had in hospital of a man with nine pupils, one of them almost central, the other eight ranged peripherally. Eventually he developed glaucoma, probably having a relation to the congenital defect in the development of the angle of the anterior chamber, but there was no congenital defect in the iris.

Mr. MAYOU and Mr. COLLINS discussed the probable causation of coloboma with bridge, Mr. Collins stating his opinion that the mesoblastic portion of the iris had two sources of origin; the anterior layer of the fibro-plastic sheath and the blood vessels which grew forwards from the periphery of the anterior ciliary arteries beneath the pupillary membrane.

The New Psychology and Problems of Vision

An elaborate paper on **the new psychology in its relation to problems of vision** was read by Dr. CHARLES F. HARFORD. He says that the attention of the ophthalmologist has hitherto been mainly directed to the anatomical and physiological aspects of problems of vision. In his book on *Disease of the Eye*, Parsons said, after tracing the processes of vision from the external object to the cortex cerebri, "Here the nervous impulse is transformed into a psychic impulse, which is not, and probably never can be, understood." Dr. Harford claims

that psychology can offer an important contribution to supplement physiology, and that psycho-analysis throws new light upon human thought. Many are studying psycho-pathology without having grounded themselves in normal psychology, and his object in this paper is to formulate a scheme of the working of the "Psyche" which might help to interpret many of the problems of vision. He exhibited diagrams representing the mechanism of the Psyche, divided into three sections: cognition, affection (standing for the emotional result of cognition), which led to action; secondly he showed a disk presenting the field of consciousness, which would present to the Psyche the visual and other images from external objects or from the memory. His third diagram showed six compartments which he referred to as the store-chambers of the Psyche, namely, results of careful observation, results of casual observation, amnesia of common life, pathological repression, infantile impressions, and instinctive and hereditary factors. Emphasis was laid by the author on the emotional part of the Psyche, that which activates each mental concept, which Bergson called the "energie spirituelle." He proceeded to deal with the factors of repression, association, dissociation, and apperception. He said the vision of the infant is only gradually evolved, not because of any organic defect of structure, but because of the gradual nature of the awakening of the intelligence. Strange objects, seen for the first time by normal adults, could not be recognized until they could be related to some previous visual memory.

Mr. ARNOLD WILLIAMSON read a paper on **two cases of thrombosis of a retinal vein, one showing a hole, the other a star at the macula.** He first referred to the careful paper on holes in the macula published by the late Mr. Coats, in which he summarized the various theories of causation. Monteith Ogilvie considered there were two factors concerned: the fact that the retina is thinnest at the fovea, and thicker around it than elsewhere, and the fact that waves of disturbance passing through the eye meet at the posterior pole and tear the fovea by "contre coup." Fuchs attributed it, in traumatic cases, to mild traumatic retinitis, the slight serous exudate rupturing the membrane limitans externa, so causing

the appearance of a macular hole. Coats believed oedema was the underlying cause, stating that a hole had never appeared less than 60 hours after the injury, also that opacity in the retina had been observed after injury in a case in which a hole subsequently developed. In 1908, however, Kipp and Alt published in the *American Journal of Ophthalmology* a case in which a boy was shot through the orbit, tearing the optic nerve and its sheath, and entering the skull. On the following day the retina was whiteish, and vessels narrow, except for a vein passing from macula to disk. At the macula was a red deep round spot, one third D.; two days later the retina was more opaque. Four days later the eye was excised, and there was a large hole at the macula, surrounded by swollen retinal tissue. There was evidence of oedema everywhere. Kipp and Alt consider that the retina at the macula can be torn by contre coup. Mr. Williamson showed slides of this case of his because they made clear the dependence of the formation of a hole in the macula on the occurrence of sub-retinal oedema associated with thrombosis of the central retinal vein. The patient was a woman aged 62, whose sight began to fail 14 years ago. For two years, until excision of the eye in July last, she had continual pains in the head. The eye was excised because of absolute glaucoma. Thirty years ago she had a fall, blacking both eyes, but the sight was not impaired. The excised eye showed a corneal nebula, a cellular exudate adherent to the posterior surface of the cornea in places. Hyaline exudate passing round the lens and causing some adhesion of the iris to it. There was no cupping of the disk. He exhibited sections on the screen by means of the epidiascope. There was an absence of the inner nuclear layer and inner reticular layer, and the retinal pigment layer was separated from the inner layer of the choroid. There was also some oedema in the outer molecular layer of the perimacular region. The special point was, that the cyst was formed not in the retina, but in the accumulation of oedematous material between the membrana limitans externa and the retinal pigment layer. In consequence of the presence of this cyst the outer layer of the retina appeared to undergo a degenerative process, so allowing of the formation of a hole.

The second case was also discussed at length, and sections

exhibited and demonstrated. In both cases there seemed to be a toxic influence, as shown by the iridocyclitis, acting on the retinal veins and producing thrombosis, and acting on the delicate macular choroidal capillaries, causing degeneration of their walls, increased permeability to fluid, and hence oedema; this fluid then osmosed through the potential space between the rods and cones and the pigment epithelium, preventing the access of nutrient materials from the choroido-capillaris, so that the superjacent retina degenerated and formed a hole.

Mr. M. S. MAYOU, discussing the paper, showed, by the epidiascope, sections from a typical case of albuminuric retinitis which he had some years ago. Here exudation was seen in two places: inter-retinal exudation, and sub-retinal exudation. He believed the albuminous fluid in the layers of the retina was derived from the retinal vessels, but the sub-retinal fluid he thought came from the choroid. The two had a different consistence and response to the staining reagent.

On Friday, December 9, 1921, this Section held a Clinical Evening, the President, DR. JAMES TAYLOR, C. B. E., occupying the Chair.

Hyaline Bodies in Disk, with Night-blindness.

Mr. MALCOLM HEPBURN showed a patient with this condition of hyaline bodies in the disk, the interesting feature being the associated night-blindness. Sometimes these bodies were seen with pigmentary degeneration of the retina, but in this case there was none of the latter. Possibly there might be retinal degeneration without pigment, but in all cases of such degeneration there was a ring scotoma, and this case had not one. The fundus was of the albinotic type, and his brother, who was under the care of Mr. Treacher Collins at Moorfields, had a similar kind of fundus. The exhibitor had never yet found the symptoms of night-blindness in an albino. The patient was also a myope, and true night-blindness was sometimes found in myopes. The night-blindness in this case he regarded as a coincidence.

Macular Mass, for Diagnosis.

Mr. C. LONGWORTH BLAIR showed a man with a mass at the macula, of uncertain nature and origin. For $2\frac{1}{2}$ years there had been difficulty in seeing with that eye.

Mr. RAYNER BATTEN mentioned a case of his own in which there was a mass in the middle of the macular region, and it definitely followed scarlet fever and ear trouble. During the year he had been watching the case there was no increase in the size of the mass; indeed the retina had latterly been more healthy looking. He thought it was inflammatory, also Mr. Blair's case.

Mr. J. H. FISHER thought there was little evidence of inflammation, but that there was a cystic element in the case.

Mr. M. S. MAYOU spoke of a case with a similar appearance he had now under care, a child aged 12, who had a good deal of keratitis punctata, and there were enlarged tubercular glands in the neck, proving the case to be inflammatory, and as such he regarded Mr. Blair's case.

Cyst of Iris.

Mr. R. R. CRUISE showed a case of this nature, as to which there was no history ascertainable as to inflammation or injury. His inclination was to regard it as a retention cyst associated with crypts towards the base of the iris, the crypt mouths having become occluded by the continued secretion which was not being evacuated. There was an opacity of Descemet's membrane, giving to the limbus a grayish haze. The stroma of the iris seemed to be excavated, and the base of the cyst seemed to be formed by the posterior layer of the iris. The tension of the eye was normal, and there were no signs of synechiæ. It was a flattened pupil. It was necessary to think of possible increase of tension caused by the fluid, and he invited advice as to operation. There were no fundus changes to be made out.

Mr. W. H. McMULLEN reminded members of a case of cyst of the iris which he showed 18 months ago, with very clear contents. There was no history of injury in that case either. The condition appeared to have dated back to infancy, when

the child had a cyst removed at a hospital, and it subsequently recurred. At the meeting referred to it was suggested that the child might have received a puncture wound in the eye from a secreted pin in the pillow. Cases had been seen in France in men who were exposed to fragments from exploding shells. The case he referred to was still in practically the same condition. He advocated leaving these cysts alone, because of the danger of conveying the epithelial cells where they would be a danger; moreover, if the cyst was not obviously growing it did not seem to do any harm.

Mr. M. S. MAYOU thought the difficulty was that when the cyst collapsed the edges came together again and formed a fresh cyst round the margins of the old one. In one case the eye of which he examined in the Pathological Department, operation had been done and very acute iridocyclitis followed. For this the patient did not come to hospital, and sympathetic trouble developed in the other eye, and it went quite blind. In another similar case the eye had to be removed. He agreed with Mr. McMullen that they should be left alone.

Mr. HINE mentioned a similar case of his own, in which his passive attitude received support.

Mr. J. H. FISHER objected to the impression going out that operation on these cysts was attended with danger subsequently. He thought Mr. Cruise's case was one of retention cyst, and considered that puncture promised success.

Coloboma of Optic Nerve

Mr. J. F. CUNNINGHAM showed a patient with coloboma of the optic nerve, which he considered was traumatic. The eye was highly myopic, and there was no perception of light. No history of injury could be gleaned, however.

Mr. HEPBURN's view was that the case was congenital. In all the cases of the kind he had seen in which there was trauma, there was a great development of fibrous tissue, and often heaped-up pigmentation, features which were absent from this case.

Mr. MAYOU suggested it was probably a birth injury. He did not think there was always necessarily a mass of fibrous tissue in front of the nerve after evulsion of it; certainly if the

nerve head was torn out from the scleral foramen such a fibrous mass did not necessarily occur.

Sclerosing Keratitis.

Mr. LINDSAY REA showed a case with this condition, which came on very insidiously, without any noticeable inflammation. The Wassermann test was negative, and tubercle did not appear to come into the picture, but she had three very bad teeth, which he considered were the cause of the trouble, and they were being removed.

Restoration of Lower Lid after Gunshot Wound.

Mr. M. W. OLIVER, who is working at the Sidcup Hospital, showed an ex-officer whose lower lid was carried away and the eye destroyed by a gunshot in the war, and who was anxious to wear an artificial eye. He described by means of slides the grafting he did, and illustrated the various stages, emphasizing the importance of lining the flap.

He was congratulated on the result by the President and Mr. Goulden, the latter remarking that in a case he did he did not line the flap, not knowing its importance, and the result was quite satisfactory notwithstanding.

Motais Operation for Congenital Ptosis.

Mr. R. AFFLECK GREEVES showed a patient on whom he had performed a Motais operation for congenital ptosis; he intended doing the same for the other eye. He was complimented on the result by the President and Mr. Cruise, the latter referring to a similar case in which he did the operation, with excellent results. He remarked on the successful closure of the eye during sleep, despite the fact that the innervation of the muscle pulling the eye upwards was the same as for that which pulled the lid upwards, the orbicularis obviously overcoming the action of the other.

REPORT OF THE PROCEEDINGS OF THE SECTION
ON OPHTHALMOLOGY OF THE NEW YORK
ACADEMY OF MEDICINE.

BY DR. CONRAD BERENS, JR., SECRETARY.

MEETING OF NOVEMBER 21, 1921. DR. L. W. CRIGLER, CHAIRMAN.

Dr. TALBOT R. CHAMBERS read a paper on **trifocal lenses** which appears in this issue.

DISCUSSION: Dr. CLAIBORNE said a bifocal lens was presented by him before the Am. Ophth. Soc. and several times before this Section. The glass suggested by Dr. Chambers bears a striking likeness to his in that the kryptok disk is imbedded in the foundation glass. Dr. Claiborne placed a paster on the concave side of his foundation glass so that the distance correction was above the kryptok and the near glass was the combination of the paster plus the kryptok. He does not know whether Dr. Chambers was aware of his work in this matter or not. Dr. Chambers claims to have added another focus to his glass for intermediary distances between far and near. If this can be done successfully it is a great addition, but the glass first suggested by Bausch and Lomb and later perfected by Dr. Claiborne was the basis of the suggestion of Dr. Chambers.

Dr. CHAMBERS, in closing, stated the cost would probably be half more than an ordinary bifocal kryptok. It could only be made by a high grade mechanic and it is necessary to provide a cemented wafer for protection in the grinding and this is thrown away on completion of the job. There is no chromatic nor prismatic aberration as shown by sample displayed.

Dr. H. H. TYSON showed a young man, 28 years, with a

pituitary struma who was presented before this Section on March 17, 1919, as one with a recurrence of the growth after an operation for its partial removal two years before by Dr. Harvey Cushing of Boston, on account of poor vision in his right eye with visual fields indicating pressure on the optic chiasm. Doctor Cushing made a right transfrontal osteoplastic exposure with partial removal of the pituitary struma which he described as a soft reddish mass protruding between the legs of the chiasm. Portion removed was 2cm in diameter. He remarked at the time that it was surprising that the left nerve was not the more damaged of the two as it was pushed far to one side.

Vision previous to operation was O.D.=p.l., O.S. $\frac{2}{3}$ with bitemporal hemiachromatopsia; six weeks after operation vision was O.D. $\frac{2}{3}$, O.S. $\frac{2}{3}$, and visual fields were normal. About one and one half years later vision began to fail in his left eye. He took pituitary and thyroid extracts alternately for four months. October 22, 1918, O.D. $\frac{2}{3}$, O.S. $\frac{2}{3}$.

November 12, 1918, Dr. Geo. Dixon X-rayed the sella and stated that he would be inclined to regard it as some osseous malformation rather than indicating the presence of a soft tumor. March 15, 1919, vision receded to O.S. $\frac{2}{6}$, O.D. $\frac{2}{6}$, with bitemporal hemiachromatopsia, the nasal field of his left eye being encroached upon by the blind portion to the extent of 5° from the vertical meridian with contraction of all colors in nasal field. He later visited Doctor Cushing again who advised against further operative interference. During January, 1921, he consulted Professor E. Fuchs, of Vienna, who advised radium treatment and referred him to Doctor Hirsh, of Vienna, who operated intranasally, opening both sphenoidal cavities and exposing the sella turcica as much as possible. He then applied radium rays, using an Albanus carrier containing 20mg radium metal, giving five treatments from 7 to 9 hours each from March 7th to April 26th with no improvement. He then gave five treatments of from 13 to 16 hours each, May 17th to August 2d. He thought that there was some slight improvement in the fields, and that the trophic disturbances as regards fat had been reduced. He stated that the X-ray showed a flat sella bulging toward the sphenoidal cavities. During treatment when radium was filtered, no headache

occurred; but when applied through a less dense filter, a strong reaction followed.

His present condition of vision is R. $\frac{1}{2}$ with correction with temporal pallor of disk and temporal hemianopsia. Left eye blind with atrophy of optic nerve. Tension normal both.

Since returning from Vienna he has consulted Doctor Cushing who advised against any and all treatment and suggested watching the case as to progress:—as to the use of radium he stated that he had used it in much larger dosage than given in this case with no benefit. As to the effect of radiotherapy upon pituitary tumors, Doctor Quick in his paper read before this Section, stated that pressure symptoms were benefited but that trophic and metabolic changes were little influenced by either X-ray or radium. The case is presented as a follow-up case, being of interest on account of improvement having followed the different methods of treatment; viz., operation, gland extracts, and radio-therapy; with a relapse or recurrence after each; and the ultimate condition being the most unfavorable of any. The vision in these cases depends upon the site of the tumor and the direction of the pressure taking into consideration the individual tissue tolerance to pressure.

DISCUSSION.

DR. SINCLAIR TOUSEY: In a case of tumor of the pituitary body we may as in this case perform an operation which enables one to place the radium in contact with the tumor. This secures for the pituitary body the wonderful effect almost always produced by radium in lesions at or near the surface. Wherever the lesion can be seen and felt radium produces marvelous benefit as in a case of tumor of the orbit which Dr. Bell and I showed at a meeting of this Section a couple of years ago, a tumor about as large as an orange, diagnosed as sarcoma, completely and permanently disappearing.

Without an operation radium could be less effectively applied to the pituitary body than the X-ray.

A recent improvement in the X-ray apparatus and technique makes it possible now to secure five times as much deep effect as formerly without increasing the surface effect. For the

X-ray treatment of the pituitary body at a distance of several inches from the nearest surface this increased penetration means that combined with our regular system of cross-fire we are able to apply as much X-ray as we desire to the pituitary without any skin or scalp effect. It is now no longer a question of how much X-ray we can apply to the pituitary with safety to the surface tissues, but simply a question of how much we wish to apply. The cross-fire system of X-ray thereby is making a series of applications of the X-ray through different small portions of the surface, protecting all other portions with heavy sheet lead. The applications all converge, at the pituitary gland for instance, but each part of the surface is only exposed once in the whole series.

Dr. CUTLER presented a patient with **gyrate atrophy of the retina and choroid.**

P. C. is a man of robust appearance, with no history of consanguinity or eye diseases in his family. No previous illness of consequence. Wassermann negative.

Noticed failure of vision in childhood, which has progressed slowly but steadily. The chief symptoms are near-sight and night-blindness.

Vision:

O.U.: -6 = $\frac{2}{10}$; Jaeger 2 at 4 inches.

Eyes externally normal. Pupils equal and react well.
Posterior polar cataract.

Nerves and retinal vessels fairly normal. Large posterior staphyloma.

The atrophy of the retina, and partial atrophy of the choroid, is so like that described by Prof. Fuchs although less advanced than in the three cases reported by me from his notes in 1895, that I ventured to group it with them as regards its appearance. It has not, however, the characteristic feature that led to the inclusion of gyrate atrophy in the class of familial atrophies and degenerations, of which retinitis pigmentosa is the type.

It is possible that we shall find later that retinitis pigmentosa is a chronic infection to which some families are more susceptible than others, rather than a "degeneration," which, after all, begs the question.

In this case the most conspicuous source is the teeth, which are, and have long been, very bad.

Very few cases resembling this have been reported. Prof. Fuchs stated that he had not seen one like it since the group reported in 1895 and 1898, above mentioned.

DISCUSSION.

DR. CLAIBORNE said that he had seen the case before and thought it most interesting. He thought the term gyrate atrophy incorrect, not descriptive and deceptive. The arrangement of the choroiditis should be more properly described as invicted or looped, a term borrowed from heraldry. He suggested invicted or looped instead of gyrate.

Dr. L. W. CRIGLER: **Traumatic expulsion of lens in capsule.** A man, G. L., age 23, who on July 14, 1921, while walking in front of a glass window stepped on something which caused his foot to slip. In attempting to regain his balance his elbow struck the glass, breaking it. A sharp particle penetrated the left eye, at the same time lacerating his upper and lower lids. He received first aid at the hands of a general practitioner, who not being satisfied with the intraocular condition, referred him to the Manhattan Eye and Ear Hospital, where he was seen three days after the injury.

The lid wounds were of minor significance. The eyeball presented evidence of a linear incision in the cornea just anterior to the limbus, and parallel with it, in its lower outer third. There was a wide coloboma of the iris with no protrusion of its pillars through the wound. There was some blood in the anterior chamber which masked the fundus reflex. Two days later, however, a perfect view of the fundus could be had. The lens and its capsule were absent from the eye; the optic nerve and retina were distinctly seen with a +10 diopter lens. It was therefore concluded that the lens must have been expelled in its capsule at the time of the injury.

Recovery was uneventful, the wound healing smoothly with no protrusion of iris tissue. The patient left the hospital at the end of the third week with a corrected vision of $\frac{3}{5}$.

The scar in the cornea, now four months since the accident, is barely perceptible. Aside from the enlarged, asymmetric

pupil, there is no deformity. The eye is free from inflammation, and the patient's only complaint is absence of binocular single vision and the annoyance of too much light entering the eye.

Dr. Crigler said that the uniqueness of this case reminded him of the one reported by Prof. Fuchs in his textbook of an elderly man who was gored, first in one eye, and at a later period, in the other, by a bull, sustaining a rupture of the sclera and expulsion of the lens in each instance. Later, with the aid of lenses, the man obtained useful vision with both eyes.

DR. KNAPP presented a case which resembled **late infection after trephining**. The patient, 51 years of age, was operated on in May, 1919, for chronic glaucoma. Trephining was performed on the right eye and a Lagrange operation on the left eye.

Distinct filtration was established in both eyes, and the convalescence was uninterrupted. Two months later the patient returned with an inflammation in the right eye; ciliary congestion, pupillary exudate, and hypopyon. A vitreous abscess developed and the eye subsequently shrunk. The epithelium covering the cystoid scar was intact and there never was any conjunctivitis.

The condition differed from that usually found in late infections, and upon inquiry it was elicited that two teeth in the right upper jaw had been extracted two days prior to the inflammation in the eye. This suggests a possibility that the inflammation may have been an endogenous one.

DISCUSSION.

Dr. DAVIS asked Doctor Knapp if he could explain why the eye which had been trephined was infected, and the one which had the Lagrange operation (the two operations having been performed two days apart) was not infected? That is, does he consider it simply a coincidence, or that there was some special reason for it?

Dr. KNAPP in reply said that the affected eye was on the same side as the infected teeth.

Dr. KNAPP presented a specimen of a **glioma of the retina** which had perforated through the cornea.

The case occurred in a child aged three, who came to the hospital with an irregular granulating area in the center of the cornea which looked like the granulations which occur from a perforation following panophthalmitis of moderate degree.

On opening the eye, the condition was immediately recognized as that of glioma. The present condition must have been in some way or other preceded by an ulcerative destruction of the cornea.

Dr. CLAIBORNE reported a case of **sarcoma of the choroid**, which was discovered on routine examination for glasses.

Dr. WALTER B. WEIDLER presented a patient with **solid-œdema of the face**. This disease was first described by Sir Jonathan Hutchinson and affects the skin of the cheeks, lips, and eyelids, sometimes accompanied with a conjunctivitis of the bulbar and tarsal conjunctiva and at times episcleritis.

CASE HISTORY.—Mary G., age 20, Jewish, family and personal history negative. Present trouble: about twelve years ago awoke in the morning with face swollen and red. This was more or less confined to cheeks, lips, and eyelids. Was treated at Mt. Sinai Hospital with no improvement following. She left school about four years later because of the deformity and the recurrent attacks. The swelling has never at any time completely disappeared. Was treated at various clinics and the diagnosis, as well as she can remember, was "chronic erysipelas." She has also been treated as a case of acromegaly. When first seen at the Manhattan Eye and Ear Hospital about six months ago, there was great swelling of the cheeks, lips, and the right upper and lower eyelid. Some eczematous eruption about the outer canthus, with photophobia and lacrimation. Redness and congestion of tarsal and bulbar conjunctiva, with small granular deposits at the corneo-scleral margin. A culture from the nose revealed a pure growth of staphylococcus pyogenes albus. A vaccine was made and given and the swelling of the eyelids and active inflammatory symptoms subsided. The swelling of the face has not as yet been much affected by the treatment, which, however, is being continued and was followed by cure in the two other cases reported by Dr. Weidler in the *Trans. Am. Oph. Soc.*, vol. xvi., 1918.

DISCUSSION.

Dr. A. TENNER said the patient was seen five years ago at the Mount Sinai Hospital. Dermatologists thought it was a lymphatic condition, that is, an occlusion of the lymphatics such as occurs in elephantiasis. Elephantiasis, though most commonly affecting the leg, may affect the face. During the period she was under Dr. Tenner's observation the condition showed a tendency to partial subsidence for a time, to be followed by an exacerbation; one must be skeptical about the results of treatment until the case has been watched for a long period so as to be assured that the present improvement is more than a temporary one.

If one can properly class such cases as an elephantiasis, there seems to be no necessity for the addition of a new term to our already overburdened nomenclature.

Dr. WALTER B. WEIDLER showed a patient, with **asteroid bodies in the vitreous**, aged 54, Jewish, who had glaucoma of the left eye eight years ago. An iridectomy was done on this eye, but it was enucleated later on account of pain. The right eye has never had any glaucomatous signs or symptoms. The ophthalmoscopic study of the right eye at that time showed the following:—O.D., disk oval, $7 \times 8\text{mm}$, long axis 90 degrees, floating opacities, cholesterin crystals in the vitreous, small and not in great numbers. The rest of the fundus was normal.

The patient has been under observation for a matter of eight years or more and during this time these opacities increased in number and size. At the present time the vitreous is fairly well filled with large round and oval-shaped bodies varying in size from $2 \times 2\text{mm}$ to $3 \times 4\text{mm}$. They are quite luminous and in places appear in chain-like formations. It may be possible that these asteroid bodies are the later stage of the cholesterin crystal formation after some chemical change has taken place in the vitreous.

Dr. ISAAC HARTSHORNE showed a patient with **lymphosarcoma of the orbit**, with involvement of the eyeball. Exenteration of the orbit followed by radium and X-ray treatment. Recurrence.

Dr. S. A. AGATSTON: **Iritis following advancement operation.** J. B., girl, 18 years of age. Family history negative. No history of any previous inflammation. She came to Bellevue Hospital for the correction of her convergent squint. A Reese resection and tenotomy was performed on her left eye. There was not any unusual reaction after the operation. Nine days after the operation the patient developed iritis. Wassermann negative. Teeth are in bad condition; X-ray of the sinuses was suggestive of sinusitis of the left frontal, ethmoidal, and maxillary sinuses. It would appear that the traumatism of the operation acted as a predisposing cause to this manifestation of a focal infection.

DISCUSSION.

Dr. L. W. CRIGLER said that the lesson in this case impresses upon us the importance of eliminating all recognizable foci of infection before operating, the procedure becoming a more impelling one, if the eyeball is to be opened.

Several years ago he reported a case of interstitial keratitis following advancement of the externus. Blood examination revealed the presence of syphilis in the mother and three other children as well as the patient.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by DRs. A. N. ALLING, New Haven; M. J. SCHOENBERG, New York; T. H. BUTLER, London; P. G. DOYNE, London; and K. WESSELY (*Archiv f. Augenheilkunde*), Würzburg.

Edited by MATTHIAS LANCKTON FOSTER, M.D., F.A.C.S., New Rochelle, N. Y.

I.—THE EYE IN ITS RELATIONS TO GENERAL DISEASE.

1. BARTELS. Eye symptoms in encephalitis lethargica. *Klin. Monatsbl. f. Augenheilkunde*, July, 1920, p. 64.
2. BÖTTNER. Increase of spinal pressure and classification of the true forms of polycythaemia, with reference to the changes in the fundus. *Deutsche Arch. f. klin. Medizin*, cxxxii., p. 1.
3. FRIEDENWALD, H. Ocular conditions associated with arthritis deformans. *American Journal of Ophthalmology*, June, 1921.
4. HOGUE, G. I. Ocular manifestations in encephalitis lethargica. *Ibid.*, August, 1921.
5. ROHDE. Diagnostics of diseases of the cerebellum. *Neurolog. Zentralbl.*, 1920, xxxix., p. 423.
6. SCHRÖDER. Encephalitis lethargica. *Deutsche med. Wochenschrift*, 1920, p. 1042.
7. WAARDENBURG, P. J. Ocular disturbances in encephalitis lethargica. *American Journal of Ophthalmology*, August, 1921.
8. ZETHELIUS and WERSEN. Treatment of methyl alcohol poisoning, particularly as regards the visual disturbance, with lumbar puncture. *Klin. Monatsbl. f. Augenheilkunde*, 1920, p. 51.

BARTELS (1, **Eye symptoms in encephalitis lethargica**) says that the ptosis is most distinct when the encephalitis is most marked. Of the extrinsic muscles he observed paralysis of those acting vertically. The symptoms referable to the internal muscles he found to consist of paresis of the accommodation and inhibition of the pupillary reaction without paralysis of the sphincter. The ophthalmoscopic picture was usually normal, but retrobulbar neuritis was present in one case.

SCHRÖDER (6, *Encephalitis lethargica*) emphasizes the exceeding variability of the symptoms and of the course of this disease. Lethargy, a symptom of disease of the deeper parts of the brain, is present in only part of the cases. Frequently the symptom complex seems to indicate some other disease of the central nervous system. Four of six cases observed had very transient pareses of the external muscles, one had choked disk, and one incomplete optic atrophy.

HOGUE (4, *Ocular manifestations in encephalitis lethargica*) states that twenty-six deaths from this disease were reported in 1920 in the State of Wisconsin. In the first three months of this year thirty-one deaths have occurred. He places the eye symptoms in the following order of frequency: diplopia, ptosis, impaired accommodation, nystagmus, sluggish pupils, optic neuritis, papilloedema. He relates the histories of four cases.

ALLING.

WAARDENBURG'S (7, *Ocular disturbances in encephalitis lethargica*) paper is an exhaustive discussion of ocular signs of this disease based upon a study of cases published in Dutch literature together with two cases of his own. It does not lend itself to satisfactory condensation.

ALLING.

Arthritis deformans is now commonly regarded as due to chronic toxemia incidental to some local infection. FRIEDENWALD (3, *Ocular conditions associated with arthritis deformans*) describes four cases in which the eye lesions may be explained on this basis although whether they are dependent on the constitutional condition or not it is impossible to prove. There was one case of scleritis and marginal ulcers in the other three.

ALLING.

The first case of disease of the cerebellum reported by ROHDE (5, *Diagnostics of diseases of the cerebellum*) was one of shot wound behind the right ear. At first only disturbances of the cranial nerves caused by a fracture of the base of the skull were observed, and the complex of cerebellar symptoms was apparently not recognized. The left pupil was larger than the right, the reactions were intact, there was marked nystagmus up and to the left, paresis of the right abducens, no corneal or conjunctival reflex, facial paralysis, excessive movement of

the right hand to the right. The X-ray showed fissures of the base between the middle and posterior fossæ, two little foreign bodies, and a large hemorrhage at the base of the posterior fossa. In the second case the symptoms were at first uncertain, but finally indicated a tumor in the left angle between the cerebellum and the pons. The pupils were moderately dilated and reacted slowly to light; paresis of the abducens appeared first on the right side, then on the left; nystagmus appeared when the eyes were turned to extremes, most strongly when turned to the right; the left conjunctival and corneal reflexes were weakened. There was a marked choked disk on each side; a sector-like defect of the left field upward and outward; the vision of the right eye was reduced to movements of the hand, that of the left to $\frac{7}{5}$. In addition other symptoms referable to the cerebellum were present. Two operations failed to find the tumor, but on autopsy a cyst was found in the left hemisphere of the cerebellum along with remains of an endothelial sarcoma.

BÖTTNER (2, **Polycythæmia**) reports four cases of this disease which presented no signs of stasis, no enlargement of the heart, no choked disk, and only moderately increased pressure of the spinal fluid. In the fundus he found only broadened and dark veins. Two other cases had the symptoms which were absent in the first group. He believes the disease to pass through three stages: (1) an early stage characterized only by the blood picture; (2) a middle stage with marked polycythæmic symptoms; (3) a final stage with venous stasis and decompensation of the heart. A special fundus condition appertains to each stage: dilated vessels without discoloration of the papilla at first, greater dilatation, especially of the veins, with redness of the papilla later, and finally choked disk. The choked disk is not from a local cause, but from increased intracranial pressure consequent upon the hyperæmia of the brain, which also causes the increased spinal pressure.

In a case of methyl alcohol poisoning in which lumbar puncture was practiced for diagnostic purposes, ZETHELIUS and WERSEN (8, **Treatment of methyl alcohol poisoning with lumbar puncture**) observed a considerable improvement in the vision after this procedure, and complete recovery after the second puncture. Improvement was then noted in six other

cases after lumbar puncture, although in most it was only slight.

II.—OCULAR DISEASES, REMEDIES, INSTRUMENTS, AND OPERATIVE TECHNIC.

9. BELL, G. H. New method of preventing postoperative intraocular infections. *Journal A.M.A.*, October 1, 1921.
10. BRENNER. The action of parenteral injections of milk upon diseases of the eye. *Klin. Monatsbl. f. Augenheilk.*, August-Sept., 1920, p. 419.
11. FISCHODER. Injuries of the anterior segment of an eye subjected to the X-rays because of a sarcoma of the choroid. *Zeitschr. f. Augenheilk.*, xliv., p. 160.
12. HASSEL. Protein body therapy in ophthalmology. *Deutsche med. Wochenschrift*, xxix., p. 819.
13. HOLLER. Protein body therapy. *Zeitschr. f. Augenheilk.*, xliv., p. 145.
14. MASCHLER. Experiences with injections of milk. *Ibid.*, xliv., p. 184.
15. OLSHO, S. L. Electrically tinted optical glass. *American Journal of Ophthalmology*, September, 1921.
16. PILLAT. The effect of parenteral injections of milk in gonorrhreal ophthalmia of the human eye. *Zeitschr. f. Augenheilk.*, xliv., p. 178.
17. ROCHAT. Akinesia in eye operations. *Klin. Monatsbl. f. Augenheilk.*, August-September, 1920, p. 177.
18. V. SZILY. The blind spot utilized to reveal simulation of mono-lateral blindness. *Ibid.*, July, 1920, p. 1.
19. WRIGHT, R. E. Blocking of facial nerve in cataract operations. *American Journal of Ophthalmology*, June, 1921.

BELL (9, **New method of preventing postoperative intraocular infections**) reports four hundred operations without a primary infection. His method consists in dropping of a one per cent. silver solution into the eye two hours before operation. He thinks that the silver, by stimulation, produces a leukocytosis and protective substances are formed which take care of the microorganisms if any are present, hence he does not hesitate to operate even if the smears show bacteria. He further emphasizes the importance of what he calls the three T's—teeth, tonsils, and toxemia as the cause of infection.

ALLING.

WRIGHT (19, **Blocking of facial nerve in cataract operations**) has used this method in one hundred cases known as

"squeezers," who seem likely to make trouble. He injects two per cent. novocaine along the trunk of the facial nerve and is greatly pleased with the accompanying flaccidity of the orbicularis.

ALLING.

FISCHOEDER (11, *Injuries of the eye by the X-rays*) reports a case of sarcoma of the choroid, for which X-ray treatment was tried, after enucleation had been declined, in spite of the poor prospect of success shown by previous experiences. The treatment consisted of two series of irradiations, each of ten in fifteen days, concentrated from various directions upon the globe, the superficial dose at each sitting being 300 units, and the tumor, situated an average distance of 10cm beneath the skin, received from 600 to 750 units in each series. No influence was observed to have been exerted upon the tumor, but changes were produced in the anterior segment of the eye. Eight days after the conclusion of the second series a conjunctivitis appeared together with punctate opacities in all the layers of the cornea, which seemed to be minute infiltrates and gradually passed away. On the twenty-first day after the end of the treatment small, white, granular opacities appeared in the epithelium and quickly disappeared. No histological explanation is given of this last condition, which has not hitherto been known. Although the corneal opacities disappeared and the lens remained clear, the vision remained greatly impaired, so it is thought that the retinal elements also were harmed.

According to MASCHLER (14, *Experiences with injections of milk*) there were treated in this manner 36 cases of iritis, 21 of infection and irritation of the iris after injury, 11 of post-operative infection, 24 of corneal ulcer, 6 of serpiginous ulcer, and 3 of late infection after Elliot's operation. The best results were obtained in the cases of postoperative and posttraumatic infection; in 17 out of 42 of these the infection was overcome by the milk treatment. The results were very good in the cases of acute iritis also, although recurrences not infrequently made renewed injections necessary. He often obtained good results in torpid cases of tuberculous iritis, and likewise in corneal ulcers which were not serpiginous, especially those of eczematous origin. The absorption of large intraocular hemor-

rhages was hastened several times by the milk injections. On the other hand the treatment was ineffectual in trachoma and parenchymatous keratitis. It is to be added that along with the good, often brilliant, results, unexplained cases of complete failure occur. It is also to be noted that occasionally infiltrates appear at the places of injection, that the fever may last as long as three weeks in feeble, and particularly in scrofulous, children with no explanation to be afforded by any internal condition, that in cases of latent tuberculosis the process in the lungs occasionally flares up after the injection, and that in deep ulcers the stormy melting away of the tissue following the injection may frequently lead to perforation.

PILLAT (16, *Effect of parenteral injections of milk in gonorrhreal ophthalmia*) sought to learn whether it is possible to cure gonorrhreal ophthalmia by the intragluteal injection of from 2 to 10ccm of fresh milk which has been boiled for three minutes as an exclusive treatment. Twelve out of seventeen cases responded promptly. The gonococci disappeared within eleven days. Pillat recommends an injection on the first and second days, treatment with silver when the swelling subsides, and if gonococci are still demonstrable, injections on the fourth and fifth days. The discharges must be kept washed away of course. He considers the rise of temperature, to which gonococci are particularly sensitive, to be the efficient agent, but adds that recoveries were observed with a temperature of 38° and that the gonococci persist longest in the specially protected retrotarsal folds.

HASSEL (12, *Protein body therapy in ophthalmology*) dealt with sodium nucleinic acid, particularly Merck's preparation called deuteroalbumose. This he used in the form of a 10% watery solution as an intragluteal injection, given from one to three times at intervals of one or two days, the daily dose not exceeding 0.6. The diseases treated were eczematous conjunctivitis, severe catarrhal conjunctivitis with involvement of the cornea, and gonorrhreal ophthalmia. No effect was produced on the eczematous diseases of the eye. In some cases of grave purulent breaking down of the cornea in catarrhal conjunctivitis a very striking improvement immediately set in, so that the result was unexpectedly good. Likewise in some of the gonorrhreal cases there was a striking improvement

after the injection, usually associated with fever. When this treatment was instituted early in purely conjunctival gonorrhreal blenorhoea, the disease did not attack the cornea. On the other hand in some cases in which the cornea was badly involved, perforation could not be prevented by the injections. Hassel leaves the question open whether the febrile general reaction has a special importance, and explains the action of this form of treatment as due to an increased serous excretion from the conjunctiva and the consequent washing out of the products of inflammation together with an increased power of resistance on the part of the epithelium induced by the hyperæmia. He recommends in gonorrhreal ophthalmia deutero-albumose with thorough lavage with physiological salt solution, and the avoidance of local antiseptics.

BRENNECKE (10, **Action of parenteral injections of milk upon diseases of the eye**) found the injection of 5ccm of whole milk boiled for four minutes efficient in scrofulous ophthalmia, iritis from various causes, and gonorrhreal ophthalmia, partially efficient in choroiditis and infected perforating wounds, and inefficient in trachoma and parenchymatous keratitis. He warns against its use in serious tuberculosis, as in such cases a latent focus may again blaze up.

HOLLER (13, **Protein body therapy**) opposes the use of milk because it varies much in composition and incurs the danger of a fatal anaphylaxis. The deuteroalbumose now put out by Merck is not chemically identical with the original and is not as efficient.

v. SZILY (18, **The blind spot utilized to reveal simulation of monolateral blindness**) places the patient opposite a wall on which are three round spots at equal distances apart, and has him hold a sufficiently large screen in the middle line between the eyes. When he fixes on the middle spot he will see at the same time the right spot with the right eye, and the left spot with the left. If his right eye is blind, he cannot see the right spot; this he will claim when the blindness is simulated. Now he is made to approach the wall until he sees only one spot, that is until the images of the two lateral spots fall upon the blind spots of the two eyes; take away the screen. If he is blind in the right eye he will state correctly that he can see only the middle spot and the one to its right, if he is simulating

blindness of the right eye he will state that he cannot see the one to the right, and so betray his simulation.

ROCHAT (17, *Akinesia in eye operations*) has often used the temporary paralysis of the orbicularis recommended by Lint for intraocular operations with good results, and recommends it as a procedure which is frequently of very good service in operations for cataract, magnet extractions, trephining, etc., as it obviates the danger of loss of vitreous and similar unpleasant accidents through a squeezing together of the lids. He introduces the needle of a syringe at a point a little external to the outer, lower angle of the anterior margin of the orbit, passes it upward along the outer margin of the orbit, and injects $\frac{1}{2} \text{ccm}$ of a 2% solution of novocain into the muscle as the needle is withdrawn, then does the same thing along the lower margin of the orbit. A quarter of an hour later the orbicularis is so far paralyzed that there is no reflex closure of the lids. This passes off after an hour, and no injury due to lagophthalmos have been observed. Rochat has gone further and by injections of novocain into the superior recti prevented the upward rolling of the eye in cataract operations and iridectomies. After cocainizing the eye he introduces the needle into the tendon and passes it $2\frac{1}{2}\text{cm}$ into the muscle; after a quarter of an hour there is no reflex rotation of the eyeball upward, although voluntary rotation remains. It is not necessary to inject the inferior oblique. Usually the sensory nerves alone are paralyzed, so that reflex movements are prevented, while the motor tract and the voluntary movements are not affected.

The glass described by OLSHO (15, *Electrically tinted optical glass*) is exposed to an electric light of very short wave length and is permanently tinted resembling the amethyst sun-tinted glass which has long been recommended for protective lenses. The visible spectrum when transmitted through this glass shows absorption especially at the violet end.

ALLING.

III.—ANATOMY, PHYSIOLOGY, AND PATHOLOGY.

20. DICKINSON, G. Cranial development following enucleation in early youth. Possible effects in adult years. *American Journal of Ophthalmology*, April, 1921.

21. V. DUNGERN. **The stratification theory of color vision.** *Arch. f. Ophthalmologie*, cii., p. 346.
22. GAUDISSERT, P. **The ocular blood tension.** *American Journal of Ophthalmology*, July, 1921.
23. HESS, C. **Notable injury of the normal fovea by miotics.** *Arch. f. Augenheilkunde*, lxxxvi., p. 89.
24. PICK. **The influencing of vision by vestibular and ophthalmostatic disturbances of cerebellar origin.** *Zeitschr. f. d. ges. Neurol. u. Psych.*, August, lvi., p. 213.
25. URIBE-TRONCOSO, M. **The physiological nature of the Schlemm canal.** *American Journal of Ophthalmology*, May, 1921.

DICKINSON (20, *Cranial development following enucleation*) shows an X-ray of the skull. The orbit was about one half of normal size and the frontal sinus was greatly enlarged. The narrowing of the orbit was almost entirely from above downward. The patient suffered from severe neuralgia which was relieved by freeing the adhesions of the upper lid to the orbit and by cutting out the cicatricial tissue.

ALLING.

V. DUNGERN (21, *The stratification theory of color vision*) propounds a new theory. He assumes that each cone of the retina takes up all qualities of light, and that the various color sensations are produced by the perception of the light rays in its different layers. Red and green is perceived at one end of the outer limb, yellow and blue in the middle, green and violet (green is thus mentioned twice) at the other end. White is formed by the blending of the colors in each layer. This physical theory enables an easy explanation to be furnished of all anomalies of the color sense.

PICK (24, *Influencing of vision by disturbances of cerebellar origin*) reports concerning the vision of a patient in whom autopsy revealed a gliose degeneration in both dentate nuclei of the cerebellum. The abduction of each eye was limited, the double images separated both laterally and vertically, but the patient had never complained of diplopia. A frequent trouble was a film, in which flat and bodylike vision alternated and obscured the perception. Another similar symptom was a distortion in which the ceiling of a room appeared to be bulging out. He also seemed to see through the vertical walls of the room, probably due to diplopia.

GAUDISSERT (22, *The ocular blood tension*) describes ex-

periments which have been conducted in order to determine the systolic and diastolic blood pressure of the retinal and choroidal vessels. Bailliart seems to have gotten most deeply into the subject. Normally we see no pulsation in the retinal arteries because the blood pressure is greater than the intraocular pressure. If the tension of the eye is increased to a point where it equals the retinal diastolic pressure, the artery will empty during diastolic and fill with each systolic. If the pressure is further increased the artery will be entirely emptied. The dynamometer is devised for the purpose of increasing and recording the intraocular pressure and this measures the blood pressure, which, for the central artery of the retina, is 30mm in diastolic and 70-80 in systolic. The choroidal blood pressure may also be determined with this instrument. Studies in this field are full of promise especially in pathological conditions.

ALLING.

For many years Schlemm's canal has been regarded as a venous sinus. Recent investigation however by Maggiore, Salzmann and URIBE-TRONCOSO (25, *Physiological nature of the Schlemm canal*) have cast doubt upon this view. The author dissected away the conjunctiva of the eye of a rabbit drawing out the globe and immersed it in oil in such a way that any secretion from the limbus would be collected. He found that the fluid was clear and concluded that it was aqueous humor. It has also been shown morphologically that the canal has not the structure of a vein but closely resembles a lymph channel. Salzmann by means of the slit lamp and corneal contact glass demonstrated that the region of the canal appeared as a clear zone and therefore was not filled with blood.

ALLING.

HESS (23, *Notable injury of the normal fovea by miotics*) made a very interesting entoptic observation. If one moves a little aperture, $\frac{1}{2}mm$ in diameter, in a black card rapidly back and forth in front of the pupil, the capillary system about the fovea in the normal eye becomes distinctly visible and the non-vascular area of the fovea appears shagreened. About twelve minutes after the instillation of a drop of a 2% solution of pilocarpine the capillaries begin to become invisible, and in the region of the foveal shagreen appear dark points with

bright margins, which finally form a dense mass of very dark globules. The retinal area in which this phenomenon is visible is estimated from 0.3 to 0.45 mm. The entoptic picture lasts from one and a half to two hours. With weaker solutions the phenomenon is less marked and is delayed. If homatropin is instilled one or two hours before the pilocarpine, the phenomenon does not appear, even though the pupil is made smaller than normal by the miotic. Control experiments show that the phenomenon is independent of the size of the pupil, and of changes in the tension. Inhalations of amyl nitrite and instillations of adrenalin had no such effect. Hess ascribes it to a toxic impairment of the middle portions of the retina. The experiment shows not only how minute is the quantity of the miotic needed, but also a new way to observe the influence of poisons upon the living tissue of the retina under a considerable enlargement, and much better than is possible under the microscope.

IV.—REFRACTION AND ACCOMMODATION.

26. CLAUSEN. The nature of myopia in the light of modern theories concerning heredity. *Vereinig d. Augenaerzte d. Prov. Sachsen, Anhalts u. d. Thüringer Lande*, June 13, 1920.

27. EDRIDGE-GREEN, F. W. The cause and prevention of myopia. *The Arris and Gale Lecture*.

28. FUCHS, A. A case of biastigmatism. *Ophthalmic Society of Vienna*, June 21, 1920.

29. LEWIS, F. PARK. Focal adjustment in the aphakic eye. *American Journal of Ophthalmology*, April, 1921.

30. LOEB, C. Why we accommodate. *Ibid.*, April, 1921.

31. PÖLLOT. Transient changes of the refraction of the eye in diabetes mellitus. *Fortschritte d. Med.*, lvii, (7) p. 214.

In the effort to explain the nature of the stimulus which results in accommodation as the eye is focused for a near object LOEB (30, Why we accommodate) suggests that it is the passage of light obliquely through the perceptive elements of the retina from the periphery toward the center which causes the act. Light from a near object, with the eye at rest, would focus behind the retina and the rays would converge as they strike the retina. The individual learns from the sensation produced by the obliqueness of the rays that a certain muscular

effort is required to permit the object to be seen clearly. The premises in his argument would be readily admitted.

ALLING.

In this lecture EDRIDGE-GREEN (27, **The Cause and Prevention of Myopia**) deals with acquired myopia. The popular view has been that the convergence of the eyes, necessary for reading, has been the dominant factor in producing, by pressure of the extraocular muscles on the globe, that elongation of the eyeball which necessitates the use of concave lenses. Edridge-Green contends that this view is erroneous. He quotes authorities and figures in support of his view. Of the latter the figures of the incidence of myopia in Lanarkshire are of interest:

Urban districts	17	per cent.
Rural districts	20.5	per cent.
Mining		
Agricultural		
Manufacturing		

} 26 per cent.

In convergent squint the squinting eye is usually hypermetropic and as regards occupations, such as compositors, lithographers, etc., in which a large proportion of myopes are found, it is arguable that the occupation was selected on account of the myopia rather than that it was the cause of the condition. Edridge-Green allows that heredity plays its part in the production of myopia in that the sclerotic may be especially prone to give way under pressure or to become affected by disease. Allowing therefore that heredity may be a predisposing cause, Edridge-Green would place most importance on two factors for the production of myopia.

1. Certain diseases occurring in early youth: measles, whooping-cough, and bronchitis. The latter two diseases probably produce their effects by the intermittent rise of intraocular pressure which they cause; while measles has, in all likelihood, a specific action on the sclerotic causing it to soften.

2. The act of lifting heavyweights from a stooping position. The type of person who is especially prone to be affected in this way is one who takes little exercise but who at intervals has to carry heavyweights.

A feeling of tension in the eyes and headache may be noticed

after much lifting. Coughing also may be a potent cause and in adolescents often defective sight may be first noticed after an attack of bronchitis.

Edridge-Green describes color phenomena after lifting heavy weights which he attributes to the circulation of fluids in the interretinal space. The eye is an organ which possesses only a slight degree of distensibility. It is kept distended by the intraocular pressure. The elastic tension of the sclerotic is of great importance and only when the sclerotic is not strong enough to resist the internal pressure upon it does it stretch and produce myopia. This is particularly liable to occur when the eye is soft and growing, but under great stress it may occur at almost any age.

The intraocular pressure varies with the arterial pressure but there is the control mechanism of the capillary venous pressure and the aqueous or secretion pressure so that whereas arterial pressure varies enormously the intraocular pressure only does so to a slight extent. Intraocular pressure rises both when the arterial pressure increases and when the capillary-venous pressure increases. The effect of weight lifting on the intraocular pressure is far in excess of that caused by the extra-ocular muscles in the act of convergence.

Edridge-Green points out that the drainage from the posterior parts of the globe is less free than from the anterior regions and that this may be a factor in the yielding of the posterior portion of the sclera in acquired myopia. Edridge-Green quotes cases illustrating the sudden onset of myopia after extreme effort.

Regarding preventive measures; he advises the abolition of all exercises for children which produce a rapid rise of intra-ocular pressure and in addition to good hygienic surroundings, strongly insists on the importance of preventing the acts of reading and writing being performed in the stooping position or with the eyes cast down, rather the eyes should be directed forwards and the head raised as much as possible.

P. E. DOYNE.

CLAUSEN (26, *Nature of myopia*) declares that a distinction between congenital and school myopia is impossible, because the differentiation must be arbitrary and inaccurate. Conclusions as to the harmful influence of near work drawn from

statistics concerning the increase of myopia in the high schools are of no great value unless an equal number of former students in the lower schools of like age are examined for comparison. Further it is not alone the students who read and write most who become near sighted, and high myopia does not commonly increase after the end of the period of growth. In a quite considerable number also myopia is already present before the school age. Clausen found among the Austrian recruits myopes of all grades who had never been to school, or had been engaged in near work. In such cases heredity must be assumed. Heredity can often be demonstrated when an examination is made of the collateral relationships. He shows by an example that heredity follows certain laws in myopia, and that these agree with Mendel's law of heredity. He believes the idea of school or work myopia to be untenable. No one who has not a predisposition towards myopia will be made near sighted by reading or writing, but anyone thus predisposed will become myopic under the most favorable hygienic conditions. Whether the degree of myopia may be increased by unfavorable conditions, he leaves an open question.

PÖLLOT'S (31, **Transient changes of refraction in diabetes**) patient was a man 34 years old, who had a myopia of 1.5 D., and fell sick with diabetes mellitus. Simultaneously with the onset of the disease his vision improved and he was found to be emmetropic. After four weeks of treatment he was free from sugar and a myopia of 0.5 D was demonstrated after paralysis of the accommodation. A year later the myopia had returned to its original 1.5 D.

FUCHS' (28, **Biastigmatism**) patient, a physician, had good vision with a weak cylindrical correction of a myopic astigmatism, lines appeared to be wavy with one eye, and letters not to be in line. With two cylindrical lenses placed not vertically to each other this trouble was relieved and the vision improved from $\frac{1}{2}$ to $\frac{1}{3}$. This result was arrived at by subjective methods, as skiascopy was misleading. (A similar case was reported by M. L. Foster in the *Refractionist* for May, 1894).

In order to explain the occasional case of good vision in an aphakic eye with the same lens for near and distance LEWIS (29, **Focal adjustment in the aphakic eye**) imagines that the vitreous has a greater density in the center as is known to be

in the case of an ox. He thinks this lens-like structure would be forced forward by the action of the ciliary muscle thus increasing the refractive power of the eye.

ALLING.

V.—THE MOTOR APPARATUS OF THE EYE.

32. BAB. **Psychogenous components of the diplopia in a case of encephalitis lethargica.** *Neurol. Zentralbl.*, xii., p. 391.
33. GOLDSTEIN. **Some unusual symptoms on the part of the lids.** *Deutsch. Zeitschr. f. Nervenheilk.*, lxvi., p. 17.
34. LEIDLER. **Syringomyelia with pure rotatory nystagmus.** *Monatsschr. f. Ohrenheilk u. Laryng.-rhinol.*, liv., p. 410.

BAB'S (32, **Psychogenous components of the diplopia in a case of encephalitis lethargica**) patient had a paresis of the right abducens with a consequent diplopia. A notable psychological complication was the appearance of colored double images when no colored glass had been used for testing and a continual change had been made in the images. There was no doubt concerning the presence of the diplopia, which disappeared after five days, because it caused great annoyance in spite of the existing lethargy. He does not believe it a matter of hallucination.

In two cases of serous meningitis with choked disk GOLDSTEIN (33, **Unusual symptoms on the part of the lids**) observed that the movements of the eyes and lids were normal when the patient looked downward, but that when he looked up a broad band of sclera became visible above the cornea, which varied in breadth. The phenomenon resembled Graefe's symptom, except that it appeared when the patient looked up, while Graefe's symptom appears when the patient looks down. In these cases the condition was one not of irritation, but of insufficiency, a holding back of the movement of the globe behind that of the lid. Probably an incoördination of the eye muscles was present, as there were no other signs of a true paresis of the elevator of the eyeball. Possibly the impulse to the levator was increased through the involvement of the tract controlling the movement of the eye. A monolateral gaping of the palpebral fissure (Dalrymple's symptom) is easy to detect because the skin is folded more strongly in consequence of the increased muscle tonus. The gaping is more marked on the

part of the upper lid because the tonus of the levator is added. In two cases of tetany Goldstein saw the upper lids drawn back to the upper margin of the orbit. In one case when the patient looked down both lids remained back, and then, when he looked still further down, one lid followed with a jerk. In spastic conditions of the levator he observed an increase of the curvature of the upper lid. The widening of the palpebral fissure in facial paralysis he looks upon as a paralytic Dalrymple's symptom, the retardation of the lid in looking down as a paralytic Graefe's symptom.

In a woman 47 years old with syringomyelia LEIDLER (34, **Syringomyelia with pure rotatory nystagmus**) observed a rotatory nystagmus to the right which increased on looking to the right. Syringing the ear with cold water induced a horizontal nystagmus without influencing the spontaneous form. He inferred a lesion in the most caudal portion of the vestibular center.

(*To be continued.*)

BOOK REVIEWS.

I.—**Atlas of the Slit-Lamp. Microscopy of the Living Eye.** By PROF. DR. ALFRED VOGT (University of Basel). An authorized translation by DR. ROBERT VON DER HEYDT, Chicago. Published by Julius Springer, Berlin, 1921. 136 francs (Swiss).

Professor Vogt's Atlas is of scientific, as well as practical, interest to every ophthalmologist. It opens up a new field for investigation and will undoubtedly create as much furor as followed the appearance of the first Atlas of Ophthalmoscopy.

The "Histology of the Living Eye," as the enthusiasts call it, was made possible by the combination of the Gullstrand slit-lamp with the Zeiss-Czapski binocular microscope. The Gullstrand lamp illuminates the tissues in such a manner as to make it possible to the observer to see the normal and pathological tissue changes as never before. The magnification obtained ranges between 10 and 108 times. The higher magnifications are meant for minute observations and require perfect, but rarely obtainable, immobility of the eye. By this method we are enabled to see in the living eye changes which in former times could only be surmised from the study of microscopic specimens. The satisfaction is given to us of obtaining first-hand information from observing the tissues of the living eye.

The technic of using the apparatus is difficult and can be acquired only by practice and careful attention to minutest details. Prof. Vogt describes 4 methods of examination:

1. Direct lateral (focal) illumination.
2. Transillumination.
3. Direct lateral illumination of reflecting surfaces.
4. Indirect lateral illumination.

Each method has its own indications and brings into view parts of the anterior portion of the eyeball which could not be seen by a different method. The mastering of these methods depends very much on one's thorough familiarity with the apparatus, the very accurate adjustment of the focusing lens and of the angle of incidence of the ribbon of rays thrown by the slit-lamp on the observed eye. It is superfluous to say that unless the technic is thoroughly mastered the study of the eye by high magnification is not satisfactory. The first 21 pages of the atlas try to convey to the reader as accurate an idea as possible of the proper technic. The technic is undoubtedly difficult and it would seem to the reviewer that this introduction could with benefit be amplified.

The second part of the atlas contains a large number of plates illustrating findings which have never been described before:—remnants of the tunica vasculosa lentis, the framework of the vitreous, the various types of lens sclerosis, the appearance of the endothelium on Descemet's membrane *in vivo*, the nerve fibers in the cornea, folds in Descemet's and Bowman's membranes, and the circulation in new-formed blood vessels in the cornea. New light is thrown on the development of the lens, and its pathological changes; on the genesis and morphology of senile and congenital cataracts; on a great variety of pathological manifestations in the vitreous, such as absorption of the supporting structure, senile and pathological hypertrophy, opacification, deposits of crystals, blood, pigment, and lymphocytes. New minute changes are described in injuries of the eyes, glaucoma, and sympathetic ophthalmia. Three hundred and seventy engravings and plates are accompanied by excellent explanations; these are arranged in five chapters (cornea, lens, iris, vitreous, appendix on conjunctiva and lids) and occupy about 120 pages of the second and most important part of the atlas. Some of the colored plates are real masterpieces and the reviewer has to confess his inability to state which of these are the best or the most interesting. They are all very good, extremely interesting and instructive. The bibliography containing 147 titles will be of value to those intending to go more deeply into this subject.

The study of this atlas leaves one with the feeling that we are

on the threshold of a new epoch of Ophthalmology. Parts of the book may have to be revised in the future, a good deal of it will stand unchanged; the work is destined to be a lasting monument to its author.

M. J. SCHOENBERG.

Slowly the advances made in Europe as regards our special science penetrate this part of the globe. It was so with the Ophthalmoscope, which took years before it was in the hands of every ophthalmologist, and it will take seemingly years before it will be recognized that we have made a bold step further in our scientific knowledge by the introduction of a more improved way of illumination.

After all the first and most essential thing in medicine is the diagnosis. If this can be made earlier and surer than before, we can say that we make progress.

The genius Gullstrand has given us the slit-lamp; the Zeiss people, especially Henker, had the idea of combining it with the Czapski-Schanz corneal microscope and made the handling easier. Now everybody can explore the new field.

But we must not think that we tread on virgin soil. While Germany was isolated from the rest of the world, some investigators still found time to see what could be learned with the new combination, and among others the very enthusiastic and over-elaborate articles by Koeppe succeeded each other in rapid succession.

However, in the quiet region of Aarau, Switzerland, away from universities, Alfred Vogt had begun to distinguish conditions until then unknown, even with the very imperfect illumination of some six years ago. They, in Europe, had then better lamps on the Gullstrand arc than we here; also the illumination was more central than with the present arrangement. This brilliant mind—who gave us at the same time the red-free lamp—of course took hold of the slit-lamp and in a series of articles—in the German language—showed us discovery after discovery.

Vogt has now collected most of his articles in an atlas. This contains his many published observations of the lens and entire new chapters about cornea, iris, vitreous body, and in an appendix the conjunctiva of the bulb and limbus. The 370

pictures are nearly all colored and very well reproduced. It is difficult to appreciate the amount of work which this has involved. All observations have to be made in the dark room and the stereoscopic impression must be reproduced if possible. Nearly all give the exact impression and the atlas as well as the earlier published pictures is a true, reliable, and safe guide.

The possession of the atlas does not allow the student to disregard Vogt's former articles. As lies in the nature of the atlas, the text is rather short; Vogt does not expound in it his theoretical views, nor does he go into details as to technicalities; only from time to time a hint *pour le bon entendeur*. The good literature index at the end of the book will be of material help to the beginner.

The translator is to be commended; it must have been often very hard to find an English equivalent for the German vernacular. I would only like to change the term "senile" to "adult" when speaking of the nucleus in the full-grown, as it seems to me to express better Vogt's view of the nucleus of the lens after puberty. Furthermore in the 106th volume of v. Graefe's *Archiv* he publishes a series of observations of conditions of cornea and anterior chamber which show an extensive field which has never before been explored.

In appreciation of this work in the world literature of Ophthalmology, I should like to place this book on a line with Donders's *Anomalies of Accommodation and Refraction*; it will be a work of which little if anything needs correction, which everybody has to consult who wishes to know something about the microscopy of the living eye, and to which it will be difficult to make valuable additions.

Vogt has made Basel the present center of the new Ophthalmology.

E. E. BLAAUW.

II. Des Conjonctivites. Par A. GABRIELIDES, oculiste et bacteriologue de l'hôpital français de Constantinople, etc. Pp. 756. Constantinople in Estia Galata, 1921. Price 55 francs.

This book is in part a complete, and in other parts a rather brief, compilation of all that has up to the present time been written on inflammation of the conjunctiva. The author particularly treats of those cases of conjunctivitis where bac-

teria are regarded as of ætiological importance. As the author is of the opinion that a possible organism found in the discharge of an obscure case of conjunctivitis can presumably be regarded as a cause of this inflammation, he has described a large number of cases of conjunctivitis under the name of the presumptive inciting organism. Thus he speaks of conjunctivitis produced by staphylococci, xerosebacilli, subtilisbacilli, etc.

The book is of value on account of its very careful literary research.

K. LINDNER (Vienna).

CORRESPONDENCE.

PHYSIOLOGICAL ACCOMMODATION.

SIR: In the report of the Proceedings of the Eye Section on page 63 of the January number of the ARCHIVES Dr. Duane is quoted as saying "and what Fuchs terms happily physiological accommodation." May I say that the terms physiological and physical accommodation have already been used by Hess and that I am sorry that this fact did not appear in the paper. I am etc.,

E. FUCHS.

ARCHIVES OF OPHTHALMOLOGY.

THE PRESENT TREND IN GLAUCOMA OPERATIONS: IRIS-PROLAPSE TECHNIQUE.

BY LT. COL. H. HERBERT, I.M.S., RET'D, BRIGHTON, ENGLAND.

(*With two figures in the text.*)

THIS is the last of a series of papers¹ on the operative treatment of glaucoma. The thesis already elaborated will be summarized and some practical details discussed.

GENERAL PRINCIPLES.

There is a growing body of feeling that deliberate iris-free fistulization has proved to be a step somewhat in a wrong direction; that it has served its turn in popularizing the so-called filtration operations in general; and that there is a fair prospect of eliminating dangers and defects by spreading out filtration in a line a little away from the conjunctival limbus.

In the last decade it has been conclusively shown that the majority of the primary glaucomas, both simple and congestive, requiring operation in England can be safely relieved for a period of years, and in many cases permanently, by the quite moderate drainage provided by *uniform linear iris-free* filtration. But in dealing with some of the higher grades of plus

¹ *Trans. Ophth. Soc. U. K.*, vol. xxxix. (1919), p. 218, vol. xli. (1921), p. 239, and *Brit. Journ. Ophth.*, vol. iv. (1920), pp. 210 and 550, vol. v. (1921), p. 183, vol. vi. (1922) (February issue).

tension which have lasted for some considerable time, not only would this moderate diffused drainage be insufficient, but the fact must be recognized that it is unobtainable, owing to the tendency to firm healing in these eyes. Apparently in such cases the only way of obtaining anything of the nature of wide linear filtration through the fibrous tunic of the eye is by iris-inclusion.

Hence an extension of the doctrine of different methods for different grades and types of glaucoma and for varying conditions of life. The operations of the future will, I believe, fall into two groups (a) those aiming at linear iris-free filtration, and (b) others acting through wide iris-incarceration or prolapse.

Iris-inclusion operations are advocated for two reasons: (1) with the definite aim of reducing the risk of late infection, and (2) because the relief of tension through impacted iris seems undoubtedly very much more generally permanent than by iris-free filtration. This very important fact seems to have received no recognition hitherto; it may lead to the wide use of iris-incarceration even in mild glaucomas, when the conditions are such that one cannot expect the patients to return promptly for further treatment in case of necessity. The prejudice against iris inclusion is based mainly on old, imperfect, and misleading observations. It is nowadays no more reasonable to class all iris-inclusions together, than it is to group all iris-free filtering scars as equally dangerous. Our aim is to secure safety, not only by widening the area of drainage, but in many cases also by developing protective conjunctival and iritic fibrosis.

In a quite exceptionally large experience of iris-prolapse and incarceration, I have seen sympathetic ophthalmia associated with these conditions only where the uveal tissue had been imperfectly covered by conjunctiva, or where there was almost certainly infection introduced at the time of operation or accident. And ordinary septic late infections associated with prolapsed iris have been fully accounted for by the state of the overlying conjunctiva and the presence of a sclero-corneal opening. That the iris tissue serves in itself directly and materially to aid in the passage of microorganisms inwards must be disputed (*Trans. Ophth. Soc. U. K.*, 1921, p. 247).

PRACTICAL APPLICATION.

(1) *Iris-free drainage.* Some excellent uniformly filtering cicatrices are to be seen after the most varied operations but sclerotomy in some form seems the most rational means of securing the desired result with regularity. Whatever form of incision may be adopted ultimately, my "small flap" operation, aided by very early blinking and finger-pressure in after-treatment, seems likely to make headway during the next few years.

(2) *Iris-inclusion operations.* In many glaucomas during the last few years I have attempted merely to repeat a development which had been observed in accidental wide iris-prolapse following simple cataract extractions and sclerotomies, and which I had copied successfully in a few glaucoma operations at the beginning of the century (*Trans. Ophth. Soc.*, vol. xxiii., 1903, p. 324). A wide subconjunctival fold of iris, bulging evenly and moderately (Fig. 1), gradually loses its color



FIG. 1.

throughout, by de-pigmentation and by the formation of new fibrous tissue, both in the adherent conjunctiva and in the iris tissue. At the same time subconjunctival filtration develops at the sharply bent margin of the partly flattened loop. This allows the bulging gradually to subside later. Aqueous is thus conducted under a fibrous shield to an extended filtering line situated where the conjunctiva is thick and loose. Fig. 2 shows this in diagrammatic form; on p. 13 of



FIG. 2.

the January, 1922, issue of the British *Journal of Ophthalmology* is seen the condition actually present in one of Holth's iridencleisis cases.

Such a result seems ideal for glaucomas judged to be too severe for relief by linear iris-free filtration; but it is not always obtainable. Some eyes are rendered unsuited to this particular method by the effects of former operation. A ring of fine posterior synechiae may limit greatly the width of the prolapse which can be drawn out, as also may a previous wide iridectomy. And one cannot usually expect fibrosis of a quite small prolapse. Failure to reduce tension fully may be expected if the iris is narrowed and atrophic from glaucomatous changes; the rigid iris-tissue remains impervious to aqueous.

Excluding such cases, however, one may feel reasonably certain of obtaining either fairly general fibrosis or what must be considered the next best thing. That is to say, failing general fibrosis one may expect, by widely diffused drainage under non-adherent conjunctiva, to obtain at least as safe a condition as could be got otherwise. Yet the avoidance of mistakes needs care, particularly in the control of the pupil at the operation (see below); and even apart from mistakes the treatment is at times a troublesome and tedious one. One must keep in touch with some of the cases for months, and small supplementary operations may be needed, either for defective fibrosis or for delayed or imperfect development of filtration.

Where there is not a very good prospect of obtaining general fibrosis, there is little doubt that one should aim at incarceration, as distinguished from prolapse, since the pressure of a small or uneven or perforated prolapse tends to produce the local inequalities in drainage, and the consequent conjunctival changes which we wish particularly to avoid. To keep the impaction flat and low, the one essential is to operate with the pupil well dilated, or to obtain wide dilatation immediately afterwards (see below), and to keep it up for some days. To ensure ample drainage it is perhaps often better to leave the iris uncut, or merely incised; though many excellent results have been obtained by removing a piece of iris and leaving impaction only in each angle of the wound.

Recurrence of plus tension is ordinarily less frequent with wide incarceration than with wide loop-prolapse, probably because in the former case there is less often a complete and intact iris loop.

Speaking generally, it is well unreservedly to accept the observation that unnecessary traumatism of uveal tissue greatly lowers its resistance to infection. Hence the need for gentle treatment of the iris, coupled with conjunctival antisepsis or asepsis approaching that found necessary in cataract extraction.

TECHNIQUE OF THE WIDE IRIS-PROLAPSE OPERATION.

Some of the details discussed below apply to a number of glaucoma operations.

1. *The control of the pupil* at the time of the operation and immediately afterwards is the crux of this particular method. I believe that a perfectly normal pupil would be most suitable—of moderate size, but mobile and resilient. But all of these pupils have been more or less under the influence of eserin. And the time taken to overcome the miosis with 4% cocaine instillations, aided generally by adrenalin, varies greatly, depending on the strength of the miotic and on the hardness of the eye. There should be only quite moderate mydriasis, both during and shortly after the operation. In some eyes a few instillations at three or four minutes' intervals may be enough. And in the milder simple glaucomas adrenalin may be instilled once only, at the end, or not at all; while in harder eyes, possibly congested, it may be needed before, between, and after numerous cocaine instillations.

Thus the operation can never be a "show operation," sandwiched in among others. The surgeon should operate as soon as the case is ready, as shown by the pupil; he needs to have other work at hand to fill up the time of waiting. If the action of the miotic is not sufficiently overcome, the iris may not stay in the sclero-cornea wound when drawn there. Exceptionally this withdrawal of iris may happen from unexpected rigidity of its tissue. In this case one may have to wait half an hour, or so, for fairly wide dilatation before drawing up the iris again. On the other hand, if the pupil has been allowed to become too much dilated, one may have to wait some time for its partial contraction by 1% eserin instillations. Otherwise the lax edge of the pupil may be drawn through the incision somewhat as in Borthen's operation. Aqueous escaping freely in front of the iris may then produce an irremediably blebby conjunctiva.

I have known leakage of aqueous, sufficient to prevent the desired adhesion of the conjunctiva, to happen from very wide mydriasis occurring very shortly after the operation (from adrenalin and cocaine used freely before operation, without atropin), though the pupillary margin was certainly not drawn into the wound. Evidently the contraction and the retraction of the iris towards its base were so strong that the loop of the iris in the sclero-corneal wound remained low and sufficiently taut to prevent the complete filling of the occupied portion of the wound.¹

In such cases, when it is obvious twenty-four hours or less after operation that fibrosis is unattainable, the use of atropin should be pushed in the attempt to draw prolapsed iris back into the wound and so to produce a flat incarceration.

2. *The sclero-corneal section.* In India during the war I always used a 1mm Graefe knife, sliding the conjunctiva and leaving it intact except for the one small puncture. The point of the knife was sometimes used for drawing the loop of iris through the wound, and again for incising the loop subconjunctivally, to obviate the necessity of doing this later. But recently, except where there was some particular reason to fear intraocular haemorrhage, I have used a broad keratome incision, because the much larger conjunctival opening facilitated the use of iris forceps for drawing up the iris. Where there are no conjunctival adhesions to scleral scars from former operations, I prefer to slide the conjunctiva downwards from a distance of about 6mm with the edge of the knife applied horizontally, rather than to dissect a conjunctival flap. A sufficient precaution against accidental limbal puncture is usually the subconjunctival injection of a little normal saline fluid, which should be pressed well down to the limbus. However, a minute accidental conjunctival puncture appears to be of little or no consequence, even though it may afterwards

¹ This effect of active mydriasis was well seen in a series of simple cataract extractions which I performed with maximal dilatation of the pupil, obtained by frequent cocaine instillations, aided by adrenalin and atropin instillations, the whole spread over $\frac{1}{2}$ - $\frac{3}{4}$ hour. The object was to prevent prolapse of iris by this means. This object was not always attained, but the few prolapses which occurred were extraordinarily small; and they were reduced to incarcerations invisible on the surface of the globe, by the continued free use of atropin.

lie immediately over prolapsed iris. After a few days no trace will be seen of it.

A fairly large sclero-corneal section is commonly required, close to the limbus, necessitating the use of the broadest of the three ordinary patterns of bent triangular keratomes.

3. *The prolapse.*—The fold drawn up is usually small, occupying only a half or less of the incision. It can often be enlarged by repeated pressure on the eye, beginning as soon as the anterior chamber has refilled. Light finger pressure through the lower lid frequently produces a marked bulge, with some widening of the prolapse, which subsides again on removal of the finger.

4. The conjunctival incision made by the keratome needs suturing.

5. *After-treatment.*—There is usually no need to bandage the eye. A shield affords sufficient protection, and allows of repeated inspection of the eye during the first few hours by the nurse. Eserin drops, 1%, may be needed more than once to control a tendency to wide dilatation of the pupil. And every opportunity may be taken to apply a little pressure, with the object of widening the prolapse. But even without such attention there is generally a steadily progressive enlargement of the prolapse, unless the pupil be kept very wide.

Twenty-four hours after the operation atropin is usually needed. Fair mydriasis must then be secured; otherwise there may be drawing up of the pupil and the formation of posterior synechiæ. Two or three weeks later there has been a return of plus tension in a few cases. In some cases it has given way rapidly to eserin and massage; but in others the tendency to recurrence has persisted for months, necessitating more than subconjunctival marginal incision with a narrow Graefe knife, to aid in the development of filtration. In the worst of these cases excision of a margin of uveal tissue may possibly be indicated. Should the prolapse obtained be much smaller than was desired, it is better to secure increased drainage by drawing up more iris at a subsequent small operation.

One of these means of obtaining freer filtration may be indicated also to counteract a tendency to the formation of one or more superficial leaking points in an iris-loop which is either too small or unevenly distended.

OPTIC NERVE AND ACCESSORY SINUSES.¹

BY PROF. J. VAN DER HOEVE, LEIDEN, HOLLAND.

MANKIND is given to inflammations of the nose. Every human being in his turn suffers from catarrh of the nose, one very often, the other less frequent, but nobody rests free of this nuisance, and every time we have it, the inflammation may be spreading to the accessory sinuses of the nose.

When now we bethink ourselves how very close and intimate the vicinity of those cavities to the orbit and optic nerve is, then it seems almost a wonder, that there are still walking around people, who never had any eye disease from nasal origin.

When we take out of the huge mass of eye diseases, which in lapse of time are not without some exaggeration attributed to sinus affections those which concern the optic nerve, then we have to fix our attention on several points.

1. The diagnosis of the optic nerve disease.
2. The diagnosis of the sinus affection.
3. The relations between those diseases.
4. The treatment.

DIAGNOSIS OF THE OPTIC NERVE DISEASE.

This diagnosis is less or more difficult according to the kind of nerve disease. This can be: choked disk, papillitis, atrophy, and retrobulbar neuritis. Choked disk and papillitis, though it is not always easy to differentiate one from the other, are relatively easy to recognise, because the ophthalmoscope reveals already in the very beginning that something is amiss with the optic nerve.

¹ Read by invitation at meeting of the American Academy of Ophthalmology and Oto-Laryngology, Philadelphia, October, 1921.

The diagnosis of the atrophy causes more difficulty at least in the beginning but the most difficulty is caused by the most frequent one, retrobulbar neuritis. The patients sometimes complain of pain behind the eyes in the depth of the orbit especially on movements of the eye. The ophthalmoscope is only of little support to us; in the beginning we see either nothing abnormal or a little hyperæmia of the disk, dark and strongly filled veins, till at last we find the characteristic pallor of the temporal quadrant of the disk. But then it is too late; the affection which could probably be cured before, is then usually irreparable, therefore we have to look out for symptoms which enable us to recognize the affection in the very beginning when the treatment may be more successful.

It is possible that in lapse of time the examination of the light sense will help us, till now this is not yet studied enough to be of much value and the best indices are given by the examination of the visual field. Here we find sometimes as atypical symptoms, concentric contraction of the visual field or annular scotoma and as characteristic signs: central scotoma and enlargement of the blind spot.

Till now we do not know why the first loss of function appears in the peripapillary and central fibers; we have only to accept the fact.

We know that both scotomata begin as relative, *i.e.*, for colors only, whereas later even the white light is not observed. Both scotomata can, when they enlarge, flow together and cause in this way the well-known oval scotoma including and surrounding the fixation point as well as the blind spot.

As a rule enlargement of the blind spot appears first: if only one of the scotomata develops, it can enlarge till it invades the region of the other and causes the same oval scotoma, including blind spot and fixation point.

If we find this scotoma we cannot say in which way it was formed, but only that the peripapillary and the central fibers are affected.

Of course when we find one of these symptoms we must exclude the possibility that it has any other origin; the central scotoma can be caused by degeneration or haemorrhage in the macula, etc. The peripapillary scotoma occurs in high myopia, medullated fibers, hysteria, etc.

Both symptoms are very important and we know with certainty that they can be caused by sinus affection. There are cases of enlargement of the blind spot, as well as of central scotoma, where the scotoma decreases or vanishes by treatment and comes back with every relapse of the sinus disease.

We find optic nerve affection more frequent in diseases of the posterior than of the anterior sinuses; in the latter they are rare.

These symptoms are important as they are not symptoms of a sinus affection but of an affection of the optic nerve. They show that the optic nerve is diseased but do not teach us anything about the origin of this affection and we always must remember that every retrobulbar neuritis can begin with these symptoms whether it is caused by multiple sclerosis, by tuberculosis, syphilis, dental infection or rheumatism, or by nasal disease.

So we come to our first conclusion:

THE OPHTHALMOLOGIST HAS IN THE EYE NO SIGN AT ALL TO DISTINGUISH THE ORIGIN OF A RETROBULBAR NEURITIS.

DIAGNOSIS OF THE SINUS DISEASE.

Every rhinologist will be convinced that the diagnosis of an existing sinus disease especially of a posterior sinus disease is not always easy, nay, we may say, not always possible.

So we find in Mackenzie's *Diseases of the Throat, Nose and Ear*, edited in 1920, "The absence of any sign of disease inside the nose is not sufficient to exclude sinusitis from the diagnosis."

With the purely rhinological methods of examination we are not able to diagnose a great number of sinus affections; happily we have a good support in the examination with Röntgen rays. We can photograph the sinus in different directions: occipito-frontal, when we wish to compare both frontal sinus, bitemporal and occipito-caudal according to Pfeiffer's method to compare both sphenoidal sinus.

For the ethmoidal sinus I always think the best way is the method of Rhese. We let the patient lie down on his tuber frontale, nose and ansa jugularis, and put the tube above the protuberantia occipitalia. Then we get in a normal person a

photograph where you see the frontal sinus, the orbit, and the region of the ethmoid; by this method we ought always to compare both sides.

For the ophthalmologist it is of great interest that we can get in this way an excellent image of the optic foramen and the fissura orbitalis superior, so that we can find out if something is amiss with the optic foramen. You see on these different photographs that the foramen is on the Röntgen photo a definite round hole.

We have photographed in this way many persons with fractures of the skull bones and with optic atrophy to see if we could find the reason of the latter; so you see here the callus on the base line of the skull and an optic foramen which has an hiatus at the upper side and a fissure running from the optic foramen in the skull. Here a broken baseline and a callus at the optic foramen; the baseline can also be broken by other processes as for instance by a gumma as in this case from Sonnenkalb. Here you see an optic foramen which has quite another shape after a skull trauma. I use this method also to see whether in patients with tower skull the optic foramen is free. It is said that the optic nerve affection in tower skull is possibly caused by a deformation of the optic canal and Schloesser even operates on this theory to free the optic nerve in the canal. If now I find a normal foramen I do not believe the canal much deformed and I found a normal optic foramen even in cases in which there was a mighty tower skull with choked disks.

Rhese's method shows us affections of the frontal sinus as you see in this case of an osteoma which overshadows the optic foramen, but the great advantage of the method lies in the examination of the ethmoid. So you see here obscuration of the ethmoid as in posterior ethmoiditis. How important this method can be is shown by the following case:

A physician had retrobulbar neuritis and choroiditis; he was operated upon for sinus disease several times by one of the best known rhinologists and who told him, that though he did believe that he had not opened all affected ethmoidal cells he did not dare to go further.

This man visited me in Gröningen, I found a huge enlargement of the blind spot especially for colors and a hyperæmic

disk. I advised him to have his nose treated again. The rhinologist, however, thought him to be a neurasthenic and did not wish to operate any more. The man went to Dr. De Kleyn in Utrecht. Dr. Stenvers made the Röntgen photo I show you here, and you see the whole ethmoidal region is clear except a rectangular spot close to the optic foramen and superior orbital fissure. De Kleyn opened at that spot some posterior ethmoid cells in which he found purulent secretion and from that time the man was relieved of every complaint.

So we see the Röntgen photography may be of great aid in the diagnosis of sinus disease and yet there are cases which are not found out even with Röntgen photos. The best proof of this is that from the nine known cases of mucocele of the sphenoidal sinus in no case was the diagnosis made before the opening of the sinus.

In my case three rhinologists, among them the professor of rhinology in Leiden, declared that they could not find a single sign of sinus disease. The Röntgen photograph was, as you see, not clear. Gerber supposed that this is caused by the extreme thinness of the bones surrounding the dilated sinus. When the professor of rhinology opened, on my advice, the posterior cavities a yellow green mucous fluid streamed out and now we could with a probe not only reach the roof of the sphenoidal sinus but find out that the roof was already perforated and that the sinus was in communication with the cerebral cavity.

Mackenzie is also of the opinion that even the Röntgen ray examination is not always sufficient, for he writes:

All cases must be submitted to an X-ray examination by a radiologist experienced in the skiagraphy of the nasal sinuses. But even X-ray examination is not infallible, so that in the presence of serious orbito-ocular trouble, such as optic neuritis, for example, the only satisfactory method of excluding suppuration of the sphenoidal and posterior ethmoidal cells, the sinuses most likely to set up eye disturbances, is to operate and open them up.

So we must say as second conclusion:

THE RHINOLOGIST CANNOT SAY WITH ABSOLUTE CERTAINTY THAT A PERSON HAS NO SINUS AFFECTION.

RELATIONS BETWEEN OPTIC NERVE AND SINUS DISEASE.

How is it possible that the optic nerve is affected in sinus disease?

To get an idea of this, we require an histological examination of sinus, optic nerve, and surrounding tissue in such cases, and it is a great pity we possess only very few of these.

As a rule patients do not die from sinus disease, and when a patient with sinus and optic nerve disease dies, an autopsy of the skull is rarely obtained.

We have but little chance that the scarce quantity of histological material will be increased.

This chance will be better for material from sinus tumors than from sinusitis, though the latter is more frequent.

Happily we have at least three histological examinations which are all very important: two of tumors of the sphenoid and one of a pansinusitis.

It is highly interesting to compare the first two; in both cases there could be observed *in vivo* an axial neuritis which caused a central scotoma for several months.

Birch Hirschfeld found in his case, typical degeneration of the maculo-papillary fibers present, whereas on the contrary De Kleyn and Gerlach found in their case, though the central scotoma had existed for seven months, nearly no change in the optic nerve, they only observed the veins and capillaries of the optic nerve and nerve sheaths to be more filled than usual and a little infiltration of some nerve sheaths to be present.

These two cases are typical for the clinical processes of the optic nerve disease in sinus affection, for we know we must distinguish here two forms, one which improves directly after opening the sinus, the other in which improvement does not take place or only partially.

In the former there can be, as in the case of De Kleyn and Gerlach, only small and reparable changes in the optic nerve, in the latter irreparable changes are present as in Birch Hirschfeld's case.

The clinical symptoms in the reparable cases may be caused by oedema, toxines, pressure and beginning inflammation; in the irreparable by degeneration and atrophy as a result of too long existing inflammation or pressure.

De Kleyn and Gerlach's case is important, because it shows that even after a seven months' central scotoma nothing irreparable was found so that we must never despair, though the duration be ever so long, but treat the case as soon as we get a chance.

The other case of De Kleyn and Gerlach shows us how an inflammation can extend from the nasal cavities to the optic nerve and penetrate the bony separating wall. They found on histological examination in a patient with pansinusitis with ulcerations in the nose and tear passages, infiltration around the epithelium of the mucosa of the sinus and they saw, as I show you here, the infiltration penetrate in the marrow holes of the bone and in other spots the infiltration follow a little vessel. By an unlucky accident some of the specimens were lost just from the region where the infiltration reached the optic nerve sheaths; the other cuts are so clear and distinct, that we see how the inflammation extends from the sinus to the optic nerve.

The optic nerve sheaths are infiltrated just at the spot where they are nearest to the sinus and we see that an interstitial optic neuritis starts from the nerve sheaths.

The anatomical disposition may be of great influence whether an optic nerve will be diseased in the course of a sinus affection and we know, thanks to Onodi, that the anatomical relations may be very different.

Onodi showed us that the optic nerve can pass unprotected by any bony shield through an ethmoidal cell or even through the sphenoidal sinus, whereas on the other hand in some cases the optic nerve is surrounded by a thick wall. This of course can be of great influence. If, for instance, a cell or sinus is filled with pathological secretion and the exposed optic nerve is surrounded by this fluid, the nerve can be affected; if there is only a little or no secretion at all, the nerve can become diseased by direct contact, because it passes twice through the affected mucosa.

On the other hand a swelling of the nerve from toxic oedema may cause more disastrous effects if the nerve is enclosed in a bony canal, where the swelling may even give rise to such a pressure that choked disk or atrophy is the consequence.

The bony separating wall is not an absolute protection

against invasion and in the case of De Kleyn and Gerlach, where pansinusitis gave rise to an optic nerve disease, we saw that the inflammation can penetrate the wall and cause an inflammation of the optic nerve sheaths and of the nerve itself. We cannot say, that the protection of the nerve by a bony wall is always an advantage.

As a rule the chance for the nerve being affected depends on the vicinity of the diseased sinus, and a sinus which touches the optic nerve of both sides, or of the opposite side only, can give rise to affection of both nerves or of the opposite nerve. The many variations that are possible in the relation of optic nerve and sphenoid sinus are shown by the drawing of Quix and the preparations of Onodi.

The following ways, in which a diseased sinus can affect the optic nerve, are possible:

I. By direct spreading of the inflammation as is shown by De Kleyn and Gerlach's case.

II. By pressure by the walls of a dilated sinus as we see in the cases of mucocele where every nerve in the neighborhood may become atrophic by pressure.

III. Deleterious influence may be exercised by toxines, œdema, congestion, etc.

We distinguish:

(a) *Reparable* optic nerve affections, which can exist for months and months, caused by toxines, œdema, congestion, slight inflammation, slight pressure, and

(b) *Irreparable* optic nerve changes caused by degeneration and atrophy, following the same processes as mentioned above, but in stronger degree.

For a better understanding of the way in which a sinus disease involves the optic nerve we stand in great need, not only of more histological material of sinus and optic nerve from autopsies, but also of bacteriological and histological examinations of the material, which the rhinologist obtains at operation.

THE TREATMENT.

Here we have to distinguish those cases of optic nerve affections, in which we find a sinus affection and those which

are of unknown origin, where no sinus disease can be diagnosed. The first cases are easy enough. When we find in a patient with an optic nerve disease a sinus affection present, we have to treat it. We know that a sinus disease can cause an optic nerve affection and therefore we have the right to suppose that if a sinus disease is present in the same patient with an optic nerve affection of another origin, the latter can be aggravated by the former. Where this is the case we ought to treat every sinus affection in a patient with optic nerve disease even if this is not of nasal origin. I always advise ophthalmologists and rhinologists to begin their treatment in a conservative way. Many sinus diseases are cured with a cocaine-adrenaline spray. The other group causes us on the other hand very much difficulty.

What is to be done when a patient has an optic nerve disease and the rhinologist does not find by examination, Röntgen rays included, the signs of sinus disease.

Of course the patient must be examined carefully for internal and neurological diseases. When some cause for optic nerve disease is found, I should still always warn: mind the accessory sinus. It is possible that a patient with multiple sclerosis, with diabetes, syphilis, tuberculosis, rheumatism, or post-trauma has a sinus disease and it could be very disagreeable were we contenting ourselves with one cause for the optic nerve affection and overlooking the sinus disease which might be the real cause or an adjuvant. I remember a patient who was sent to me by an ophthalmologist, because he had optic nerve disease and purulent secretion in the nose, but the rhinologist refused to open the posterior sinus, because he did not find signs of sinusitis and the patient had syphilis, so that according to the rhinologist the origin of the nerve disease was absolutely explained by the syphilis. So they waited till one eye of the unlucky patient, who only got antiluetic treatment, was absolutely blind, the other almost. In Leiden the rhinologist could not find any purulent secretion in the nose but when on my advice he opened the posterior sinus of both sides there was a purulent inflammation of both sphenoidal sinuses and of the posterior ethmoid. Soon after this the visual acuity of one eye recovered to better than $\frac{1}{2}$ but several scotomata remained and the other eye stayed blind. Not only can a

patient with multiple sclerosis, syphilis, tuberculosis, rheumatism or trauma suffer from an independent sinus disease, but he can have a sinus disease caused by syphilis, tuberculosis, rheumatism, or trauma; so that these diseases are not the direct cause of the optic nerve disease but the indirect, whereas the sinus affection is the direct cause. We ought always to examine the nose and accessory sinuses in every patient with optic nerve affection even if there is found another possible cause for this affection. When nothing at all is found, then many authors say the case is one of multiple sclerosis because this disease is in 50-70% the cause of a retrobulbar neuritis and the optic nerve affection may precede every other symptom 10 and more years. Even if this is right we cannot let our treatment be influenced by this consideration. When there is an optic nerve disease without any other symptom of multiple sclerosis, then for us the patient has no multiple sclerosis, at least we cannot perceive it and we have to treat him till he gets other symptoms of this disease. The question what to do in these cases of optic nerve disease without known origin is very difficult and they necessitate a very close coöperation of the rhinologist and the ophthalmologist. We see in other countries how necessary people think it to discuss this problem in joint assemblies of rhinologists and ophthalmologists; they did this in September of last year in Germany in Nauheim; in this year in April in Vienna, and in May in Paris. These joint assemblies were found so useful that the Société Française d'Ophthalmologie determined to have such a joint assembly every year. You Americans have the good luck to possess this Academy so that you can discuss this and other problems together as often as you like.

Now there are ophthalmologists who say that when the ophthalmologist thinks it necessary that the sinuses be operated upon the rhinologist has to obey and operate; he is in this way the handcraftsman for the ophthalmologist.

I am not of that advice! I think that an organ specialist is not only the man who knows most of his special organ, has the most practice in operating on it, but is also the man who has to guard over his organ as a precious treasure, which is under his trust, and prevent every unnecessary mutilation.

No surgeon has the right to operate, who means to mutilate

an organ, unless thoroughly convinced, that by what he is doing he is giving the best chance to the patient; he never can do any operation on the responsibility of another doctor. The case is the same in appendicitis, *ulcus ventriculi*, trepanation for tumor cerebri as in sinus disease. Of course the surgeon cannot master every special method of examination and so he has to rely on the internist when he tells the surgeon what he found by the examination of the stomach and intestinal contents, and the ophthalmologist when he tells him of the visual acuity, the visual field, the choked disk, the neuritis, etc., but then he has to examine the patient himself. When both have communicated what they found by their examination and what they think of the diagnosis then they should consult about the possibility and the desirability of operation in general and in every individual case. If the surgeon is then convinced by his own examination or by the arguments of the other doctor, he has the right to operate, otherwise never.

To return from those general remarks to the optic nerve and sinus disease our treatment will be greatly influenced by the above mentioned considerations.

1. The ophthalmologist cannot say whether an optic nerve disease is of nasal origin or not.
2. The rhinologist cannot exclude with certainty the presence of a sinus disease.
3. Opening of the sinus even if nothing pathological is found in the sinus may be of passing or permanent benefit on the optic nerve disease.

I think this improvement results from the bleeding or a change of the lymph current, in other words it acts like blood-letting or as the instillation of dionin or as subconjunctival injections.

When we ask the ophthalmologist if the sinus should be opened and he views the question only from his narrow point of view as organ specialist, he must say yes as the eye has nothing to fear from such an operation and much to gain, whether a sinus disease is discovered or not.

If on the other hand the rhinologist is asked: must we operate? he must say as organ specialist no because the nose is mutilated by the operation and there is only little chance that the nose will gain anything as is the case when a sinus

affection is discovered. The two specialists then should consult together, not in the way described by Eicken, where the ophthalmologist says: this patient will soon be blind if you do not open the sinus and his eyes will be saved if you do. Then the rhinologist has no choice but he is persuaded by unfair means for no ophthalmologist can say whether a patient will get or will stay blind, and that he will recover after operation.

Our treatment will of course be influenced by the eye symptoms; when a patient is blind or nearly blind no rhinologist will refuse to give him a last chance, but the greatest difficulty lies in the chronic cases.

Here the rhinologist must ask the ophthalmologist what can be gained by operation? What does the ophthalmologist know from literature and from personal experience about the frequency and the degree of recovery of sight after operation and in what number of cases is a sinus disease found present? On the other hand the ophthalmologist has to ask the rhinologist what damage is done by operation aside from the possibility of an optic nerve exposed in a sinus being injured by an imprudent operation. In what percentage does damage occur after a sinus operation and what is its nature? The percentage figures gathered from the literature may decide whether in general the operation is tolerated. Say for instance that in every ten sinus operations in optic nerve disease of unknown origin we find in one a sinus disease and in one that the sight is considerably increased, then we have to ask ourselves whether we have the right to operate on eight patients unnecessarily to help two. The personal experience of both specialists is of influence too, for the experience of the ophthalmologist shows whether he has good clinical sense in choosing the patients on whom he allows an operation, while the experience of the rhinologist shows whether he has had good luck as an operator or not.

Knowing the possible advantage and possible damage the consultants will then have to decide whether in a special case they will operate or not and in this respect the personality of the patient will have to be considered, for we must always keep in mind that for the patient a sinus operation is not an indifferent procedure.

Though the nose can be made tolerably anaesthetic every

patient thinks a sinus operation very disagreeable and for a nervous patient it is a terrible shock, so that we cannot deny the influence on the psyche, especially when the operation has no effect. In strong-minded people we can discuss as far as possible the question with the patient himself, in others with the family; one of them should know that it is not a question of an operation for an existing disease but an explorative operation for a possible disease, otherwise they will always think, when no effect is gained, that the operator failed to do his duty.

Acting in this way I have not met a rhinologist who refused to do a sinus operation when requested and I have been very lucky in my results, so lucky that I hope I will always have the same fortune. These considerations show that we want statistics on the results of the operation both as to the restoration of vision and as to the results of damage for the nose and statistics of what happens with the eyes of patients in whom the sinus is not opened. To get these statistics it is necessary that we all use the same terms; up to now I am not convinced that this is the case. We see that in Nauheim von Eicken compares a statistic from Heine in Kiel who found in 50,000 patients 46 cases of retrobulbar neuritis (0.092%) and among them only 3 cases of nasal origin (0.006%), and a statistic from Grosz in Budapest, who found in 18,587 patients 58 cases of optic nerve disease of nasal origin (0.312%) or 52 times as frequent. Eicken suggests that this considerable difference may be caused by the fact that Grosz perhaps regards every case to be of nasal origin in which the sight is increased by an endonasal operation. If this is true it still must be explained how it is possible for Grosz to have 3.5 times more optic nerve disease of nasal origin than Heine retrobulbar neuritis of all origins. Either the optic nerve disease must be more frequent in Budapest than in Kiel or Grosz and Heine use the same name for different affections.

I think that it is very important to have a uniform nomenclature, and to try to get statistics of the advantages which the eye derives from a sinus operation and of the damage which is done to the nose.

In conclusion may I request your help in getting statistics to solve the question, should we operate on the nasal sinuses in optic nerve disease of unknown origin?

PERSISTENT ACCOMMODATIVE SPASM DUE TO LATENT HYPERPHORIA.

BY DR. F. W. MARLOW, SYRACUSE, N. Y.

(*With one figure in the text.*)

WHY some people accept readily a full correction of their hypermetropia and astigmatism as determined under cycloplegia, and some do not, is a problem the solution of which is often unsolved.

De Schweinitz states the problem thus:

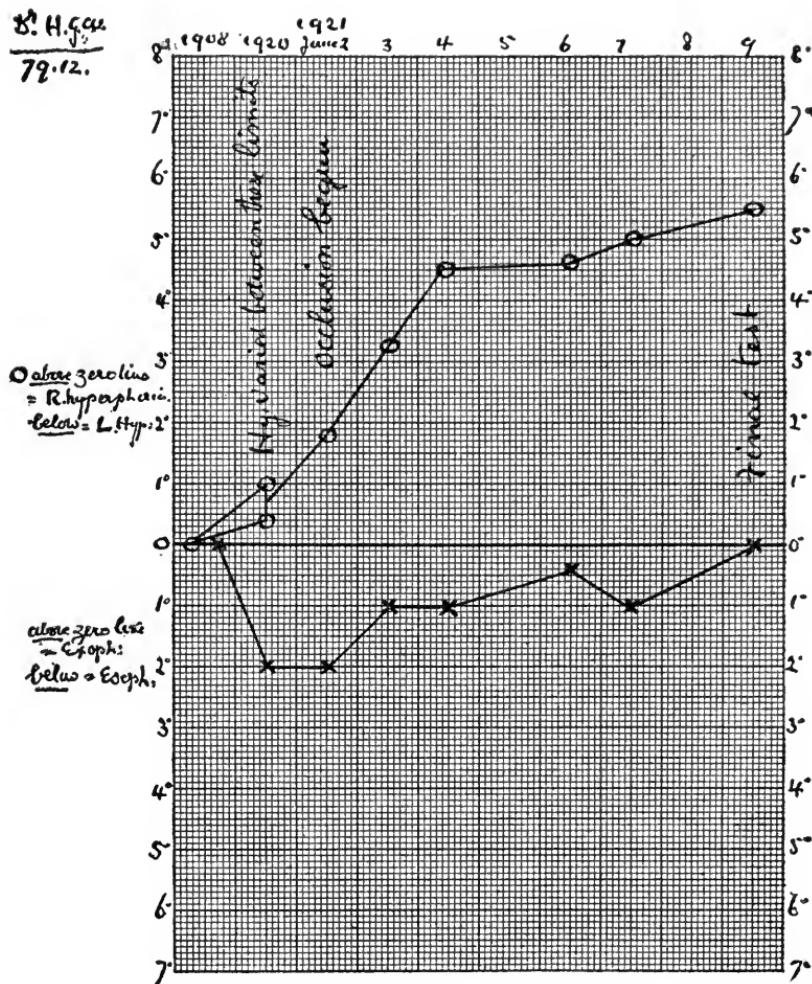
"After the effects of the drug have disappeared distant vision is often dim with the full correction, and a haze seems to lie over all distant objects, which disappears when the glasses are removed.

"Spasm of accommodation is the disturbing factor in this problem, and it is so variable in different individuals, that no precise rule can be given. Many persons wear a full correction with comfort, and do not need any modification, others will tolerate only a small part of the full correcting glass."

My own experience would lead me to modify slightly the last sentence and to say that a large percentage accept a full correction ($-0.25D.$) and a small percentage only do not. What are the factors in this small percentage which tend to maintain this accommodative spasm? The key to the solution of some problems of this kind is to be found in another paragraph of de Schweinitz—which says:

"A frequent cause of inability to wear a full correction depends upon the development of convergence insufficiency, causing an associated action of accommodation with the muscular action necessary to bring the visual axes in a parallel condition."

While it is not obvious how a convergence insufficiency would be operative in distant vision, it is easy to see how a divergence excess would have precisely the effect described in the latter half of the paragraph, and that any one of a number



of muscle anomalies may operate in just this way. In other words any excessive muscular effort necessary to bring the visual axes into parallelism may induce associated accommodative effort in excess of that necessary to maintain clear vision.

I have observed in more than one case in which at the post-cycloplegic examination the patient would not accept the full correction, that the placing of prisms in the trial frame to correct, wholly or in part, a manifest heterophoria will at once raise the vision or permit the acceptance of a stronger lens.

But in many cases there is no demonstrable heterophoria, or the correction of what heterophoria can be demonstrated does not bring about the desired result.

The following case, in which a high degree of hyperphoria was revealed by the prolonged occlusion test, and its correction followed by relief from symptoms suggests a possible solution of many other unexplained cases.

H. G. W., a medical student, seen first on Nov. 10, 1908, when he was 24 years old. He was complaining of his eyes getting inflamed, some aching, and other very slight asthenopic symptoms.

Examination showed: V. = R. $\frac{1}{2}$ - , + 0.37 S \cap + 0.37 C 110° $\frac{1}{2}$ + ; L. $\frac{1}{2}$ - 0.25 S \cap + 0.62 C 85° $\frac{1}{2}$ - orthophoria.

After scopolamin: R. $\frac{1}{6}\frac{1}{2}$ + 1.00 S \cap + 0.75 C 95° $\frac{1}{2}$ - ; L. $\frac{1}{6}\frac{1}{2}$ + 1.00 S \cap + 0.87 C 85° $\frac{1}{2}$.

At a post-cycloplegic test: R. accepted - 0.25 S \cap + 0.62 C 95°; L. accepted - 0.25 S \cap + 0.62 C 85°.

He was ordered: R. + 0.50 Sph. \cap + 0.50 C 95°; L. + 0.50 Sph. \cap + 0.62 C 85°.

He received no benefit from the glasses, which also blurred distant objects, and after a month or a longer time gave them up.

In 1911 he was re-examined: R. accepted - 0.25 S \cap + 0.50 C 85°; L. accepted - 0.25 S \cap + 0.87 C 95°, right hyperphoria $\frac{1}{2}$.

After scopolamin: R. $\frac{1}{6}\frac{1}{2}$ + 1.00 S. \cap + 0.87 C 95°; L. $\frac{1}{6}\frac{1}{2}$ + 0.75 S \cap + 1.12 C 90°; right hyperphoria 1°.

At a post-cycloplegic examination seven days later: R. accepted - 0.25 S \cap + 0.75 C 95°; L. accepted - 0.25 S \cap + 0.87 C 85°, right hyperphoria 1°.

He was ordered: R. + 0.50 S \cap + 0.75 C 95°, $\frac{3}{4}$ ° prism base down, L. + 0.25 S \cap + 0.87 C 85°, with the same result as before. After a persistent trial of some months he gave them up and went without glasses until April, 1920, when he came again on account of recent inflammation of eyelids and general exhaustion after prolonged reading.

R. now accepted + 0.25 Sph. \cap + 0.37 C 95°; L. now accepted - 0.25 S. \cap + 0.62 C 75°; R. hyperphoria 1° esophoria 2°.

After scopolamin: R. accepted + 1.25 S \bigcirc + 0.75 C 90°; L. accepted + 1.00 S \bigcirc + 1.00 C 80°; R. hyperphoria $\frac{1}{2}$.

He was ordered: R. 1.00 S \bigcirc + 0.62 C 90° \bigcirc $\frac{1}{2}$ ° prism base down; L. 0.75 S \bigcirc + 0.87 C 80°.

On June 1st he returned complaining of blur and discomfort, vision being $\frac{1}{8}$ with the glasses, brought up to $\frac{1}{4}$ with the addition of -0.50 Sph. His spherical correction was reduced 0.25 Sph. in the hope that his accommodation would relax enough to accept the remaining correction, but a year later, June 2, 1921, having worn the glasses constantly in the interval, he still complained of blur for distance, disinclination to read, and fatigue afterwards.

R accepted + 0.25 Sph. \bigcirc + 0.37 C 75°; L. accepted + 0.62 C 80°, or about the same as at his first examination on November 10, 1908. In other words the accommodative spasm remained unchanged.

Test of the muscle balance now showed R. hyperphoria $1\frac{3}{4}$ ° esophoria 2°; p.p.c. 5cm from base line; abd. 3° - 5°, exophoria at $\frac{1}{3}$ m with his glasses 3° - 4° prism; p.p. with his glasses, normal.

It had become evident that the simple correction of his refraction, full or partial, continued over a long period of time, was having no effect upon the accommodative spasm, that the latter could not be attributed to insufficiency of convergence, for that was above the normal standard, that moreover the correction of what manifest hyperphoria could be detected had no influence in relieving the symptoms, and the question seemed to arise naturally as to whether there might not be a higher degree of heterophoria present than could be demonstrated, which might on account of its necessitating increased innervation of extrinsic muscles induce also an excessive accommodative effort. In order to test this one eye was occluded with a ground glass and the effect watched. The test lasted seven days and the result is shown in the accompanying chart. The right hyperphoria increased until on the seventh day it reached $5\frac{1}{2}$ °. The esophoria diminished until on the seventh day it disappeared entirely.

He was ordered: R. + 0.75 Sph. \bigcirc 0.62 C 85°, 2° prism base down; L. + 0.50 Sph. \bigcirc + 0.75 C 80°, $1\frac{1}{2}$ ° prism base up. This correction gave prompt relief from symptoms and clear distant vision, and he has remained comfortable since.

A CASE OF METASTATIC CARCINOMA OF THE CHOROID.

BY DR. J. A. MACMILLAN, MONTREAL.

From the Ophthalmic Clinic of the Royal Victoria Hospital.

(*With two illustrations on Text-Plate XIII.*)

CASES of metastatic carcinoma involving the choroid are still sufficiently rare to justify the presentation of another. Steichele (1) fully covering the literature up to 1918, could find only 71 reports of the condition. But in itself the following case presents special changes and problems that are of interest.

Mrs. J. P., age 46 years, secretary, was admitted to the Royal Victoria Hospital, in July, 1920, presenting all the signs of an advanced carcinomatosis, which had followed a mammary carcinoma of the left side notwithstanding a radical operation in February, 1919. Three months previously the sight of the left eye had disappeared suddenly during the night in association with severe pain.

In the family history it was to be noted that the maternal grandmother had died from cancer of the breast; a maternal aunt from cancer of the stomach; and that one sister had had her breast removed for cancer.

The left eye was not injected, except for a few dilated long ciliary veins on the temporal side. The cornea was clear, there was no anterior chamber, and the left pupil was slightly dilated. One could see a mass of a dirty yellow color, in the vitreous, on the temporal side. The retina appeared detached in all directions. Tension was 40 Hg. mm with the Schiotz tonometer. On transillumination there was a definite shadow with the light placed on the temporal side. Vision was nil. A diagnosis of intraocular tumor secondary to the mammary cancer was made; and it is interesting to note that the proper conception of this

case, in which the general findings were unconvincing, grew out of the ocular examination. The woman died on August 1, 1920. The autopsy report showed metastases of the lungs, liver, kidneys, adrenals, pancreas, pituitary, dura mater, and general involvement of the lymph glands. For the sake of completeness I will say here that the sections from these organs show the same cellular structure as that of the tumor in the choroid about to be described.

PATHOLOGICAL EXAMINATION OF THE EYE.

The left eye was hardened in formalin and alcohol, and embedded in celloidin. Sections were stained by haematoxylin and eosin, and by Van Gieson's method. On excising the upper and lower segments, before embedding, the whole temporal side of the eye was found lined by a grayish-white putty-like tumor, the thickness of which varied, being greatest near the equator. It was soft in consistency, and its surface was irregular. No hemorrhages could be seen. The retina was completely detached, the sub-retinal space being entirely filled with fluid.

Examining sections macroscopically one notes the absence of an anterior chamber; the lens pushed forward; and the sclera everywhere intact. The retina is completely detached, except at the nerve-head and the ora serrata on each side. On the temporal side one sees a large mass which occupies somewhat more than one third of the vitreous chamber; it extends from the ora serrata on the temporal side to 4mm beyond the optic disk on the nasal side; and reaches its greatest thickness (8mm) near the equator. Throughout the mass there are areas which take the haematoxylin stain deeply. These are especially marked in the periphery, and stand out in sharp contrast to the eosin-stained central portion of the tumor. Similar strong affinity for haematoxylin is noted, along the temporal side of the nerve; in two minute spots, 1mm in size, outside the sclera at the posterior pole; and in a small patch (3mm) which is apparently situated in the choroid on the nasal side, 6mm distant from the nearest border of the large tumor. Everywhere beneath the detached retina the eosin stain is intense.

Microscopically the cornea is normal. The iris, thin and atrophic, with blood vessels of reduced caliber, is in close apposition to the posterior surface of the cornea. The posterior pigment layer is adherent in places to the lens capsule.

One sees the ligamentum pectinatum compressed, and Fontana's spaces obliterated. Schlemm's canal is small, and in some sections contains blood cells. The ciliary body, though flat, and with no exudate on its surface, shows many dilated and engorged blood vessels. The lens is pushed forward and in apposition with the iris. Lying against the stretched zonule on each side is a clear, highly refractile mass which, in all probability, represents the remains of the vitreous.

The tumor is made up of closely packed epithelial cells with deep-staining oval nuclei and very little cytoplasm. The nuclei are rich in coarse deep-staining chromatic granules, and show well-defined nucleoli. There is no glandular arrangement of the cells, and there is no stroma. Cells in all stages of degeneration can be seen; in fact the necrosis occupies the major part of the tumor. It is only at the margins, along the sclera, and around many blood vessels, that one finds the active cells which take the haematoxylin stain, and stand out as blue islands in the pink background of necrotic cells, as described above in the macroscopic examination. The blood vessels vary in size. Some are filled with blood, while others show an early obliterating endarteritis. One cannot definitely make out cancer cells in any of them.

The anterior margin of the tumor, on the temporal side, is wedge shaped, and extends to the beginning of the flat portion of the ciliary body, the cells having advanced along the lymph spaces of the choroid and separated its lamellæ. The nuclei here stain deeply. On the nasal side the advancing edge has the same appearance; but there is more dilatation of the choroidal vessels. The innermost part of the tumor is necrotic as I have already stated, and the only active cells are those immediately surrounding isolated blood vessels. Bruch's membrane appears everywhere intact except at a small spot near the disk, on the temporal side. Here the tumor cells seem to be continuous with the cells of another mass, which invades the retina and optic nerve. The choroidal pigment is found scattered in clumps throughout the tumor; but apart from this, there is nothing in the mass recognizable as choroidal tissue.

On the nasal side, corresponding to the dark area noticed macroscopically, is a growth 3.5mm long, the cells of which

are of the same character and invade the choroid in the same manner as those of the advancing margin of the large tumor. From its size and the staining of its nuclei, one would think the growth to be of more recent origin.

Invasion of the sclera is seen in many places adjacent to the large tumor. The cells have penetrated along its lymph spaces and separated many of its layers, the innermost of which are turned in, and appear as stroma for the overlying part of the tumor. At no place can a perforation be found.

The two dark stained nodules seen on the posterior surface of the sclera, macroscopically, are cancer cell nests, surrounded by connective tissue capsules. In some sections they are joined together and appear as one larger mass. There are no broken down cells, and the nuclei stain deeply. No direct communication with the intraocular growth can be found, but in some sections the cancer cells extend from the intraocular growth along the short posterior ciliary vessels for half the distance through the sclera.

Immediately to the temporal side of the disk the tumor cells appear to have broken through Bruch's membrane, and to have involved the retina. This involvement extends forward for a short distance ($1mm$) only, but well backward through the lamina cribrosa into the substance of the optic nerve ($2mm$). The pigment epithelium has remained attached to Bruch's membrane throughout, but the retina otherwise shows complete disintegration. The central vessels of the optic nerve are not involved, the reason being that the growth does not extend so far as to the nasal side. On the temporal side, however, its involvement is up to the pial sheath.

From the character and manner of growth of the epithelial cells, together with the absence of glandular arrangement and stroma, one could only make a diagnosis of medullary carcinoma.

REMARKS.

It will be seen in this case that we have three metastatic growths associated with the eye: the large one on the temporal side, a small one on the nasal side, and the extraocular nest lying on the sclera. It would appear from the size and the extensive necrosis that the original metastatic growth

was the one on the temporal side, and that it had penetrated Bruch's membrane near the nerve head, involving the retina, and extending from there directly along the lymph spaces into the optic nerve. The extraocular nodule is probably secondary to the large tumor, because it lies directly over the area where the short posterior ciliary arteries penetrate; and in some sections vessels with perivascular involvement can be found extending from the intraocular tumor, halfway through the sclera. Had serial sections been cut it is extremely probable that this perivascular involvement would have been found to lead to these nests. There is no involvement of the choroid between the nasal nodule and the large growth, so that the former must have had its origin by metastases through the blood stream, but from what focus, it is impossible to state. One would like to consider it as secondary to the temporal tumor; but it is difficult to assume a vascular connection. On the other hand, with general carcinomatosis, the blood stream frequently must have contained clumps of cancer cells, and I would incline to the view that one had to deal here with multiple foci.

As the original growth in this case was on the temporal side, posteriorly, it might be well to reiterate the accepted view as to the cause of the frequency in this location. It is first of all necessary to believe that metastases occur by embolism through the blood stream, as one cannot imagine the extension from the breast to the eye by the lymphatics alone. The ophthalmic artery leaves the carotid at a right angle, which probably explains the infrequency of ocular metastases. In its further course through the orbit the short posterior ciliary arteries going to the temporal side come off usually as one large branch, the axis of which is parallel to the long axis of the ophthalmic. This branching occurs at the point where the ophthalmic artery changes its course upward, so that an embolus, once in the ophthalmic, is more likely to be directed to the temporal side, along the short posterior ciliary artery.

This case yields no evidence of the view that the detachment of the retina is out of proportion to the size of the tumor in metastatic carcinoma of the choroid. Oatman (2) believes that there is an early effusion from the tumor itself to explain in part the relatively large separation. In this case, one has had

bulk and interference of the circulation as more likely causes.

Marshall (3) noticed that the tension in carcinomatous eyes was usually lower than in cases of sarcoma. This he attributed to a peculiarity of metastatic carcinomata, which are usually thin and flat, and consequently less likely to push forward the lens and iris and to block the angle of the anterior chamber. In this case there was a tension of 40 Hg.mm (Schiotz) which, although elevated is surprisingly low when one considers the large size of the tumor, and the fact that the lens was pushed forward, completely blocking the angle. The findings here seem to agree with Marshall's, in that the tension was comparatively low; but his explanation certainly does not apply to this particular case. It will be necessary to have tonometer readings on future cases to definitely confirm his findings, as the digital method was used in all the cases collected by him. An interesting feature in the sections of this case was the small amount of vitreous found, and the questions arise, if the absorption of the vitreous was compensatory to the growth of the tumor, and if this had some effect in keeping down the tension.

REFERENCES.

1. STEICHELE, HERMANN. "Über das metastatische Aderhautkarzinom." *A. F. A.*, 1919, p. 201.
2. OATMAN, E. L. "Metastatic carcinoma of the choroid; report of a case and review of the literature." *Amer. J. of Med. Sc.*, 1903, p. 375.
3. MARSHALL, C. DEVEREUX. "Metastatic carcinoma of the eyeball." *R. L. O. H. Rep.*, xiv., 3, 1897.

INTERMITTENT OPHTHALMOMALACIA.

BY DR. S. O. FIELDS, NORFOLK, VA.

WE reached the decision to report the following case, not alone because the condition is infrequently met with, but also because of certain noteworthy characteristics which seemed to merit especial attention. The case furthermore exhibits features which may prove of interest to the internist and the laryngologist.

L. D., colored, female, age 30 yrs., rural school teacher, came under my notice, Aug. 1, 1921, in the Eye and Throat Department of the Princess Anne Avenue Clinic, complaining of recurrent attacks of tonsillitis and also of occasional attacks of impaired hearing. In addition she stated that her friends had begun to comment upon the increasing circumference of her neck, but that she herself had paid no attention to it believing it simply to be an accompaniment of her increasing stoutness, although she admitted she now and then felt a sensation of moderate constriction about the throat. She also during her recital volunteered the information that her right eye had been slightly painful and sensitive to the sunlight for the last two or three days, and that such attacks occurred at irregular intervals of never more than three or four weeks in length, the attacks lasting sometimes two or three days and sometimes a week. She stated that very often when rubbing her eye at these times she noticed the resemblance to a "soft rubber ball partly filled with water." She has an entire absence of any other symptoms, and only when asked a leading question does she recall that she is annoyed now and then with palpitation of the heart.

There is nothing of importance in the family history, and also nothing in the past medical history save the frequent attacks of tonsillitis and the occasional slight hardness of hearing.

The patient is a stout, rather intelligent young woman. General examination shows an unequal bilateral enlargement of the thyroid, the enlargement being decidedly more marked on the right side; no thrill or pulsation in the gland; circumference of the neck $16\frac{1}{2}$ inches. Heart rate, 128; forcible action; no murmurs; second aortic sound accentuated; slight increase in the cardiac area. Tremor of the outstretched fingers. Laboratory examination gives us no data of interest. Systolic pressure 130; diastolic, 100mm.

Nose, normal; throat, tonsils moderately enlarged, and about 2cc of pus squeezed out of the two tonsils.

Each eye exhibits about 25mm of exophthalmos, and the palpebral fissures are increased in width, the right, however, to a much slighter extent than the left. Both eyes show Stellwag's sign, von Graefe's sign, tremor of the upper lids when gently closed, and an absence of Moebius' sign. No injection in either eye. While the left eye exhibits a normal pupil and normal tension, the right eye on the other hand shows a pupil which does not dilate when shaded and a minus 2 tension, the latter allowing us easily to wrinkle and indent the cornea by pressure with a probe. The 2% cocaine solution employed to permit the use of the probe on the cornea produced no dilatation of the right pupil. She wears a plus 0.75 D. Cyl., axis 90 degrees before each eye and a refraction done in the clinic verified the fact that the correction was correct. There is nothing else necessitating especial mention from the ocular standpoint, no eye lesions being discovered to account for the diminished tension.

She was given medicinal treatment and advice by the General Medical Department, and advised to submit to a tonsillectomy when her cardiac symptoms should have become somewhat ameliorated. She entered the clinic again Sept. 2, 1921, with her ocular tension normal and equal in both eyes and reported an attack of her usual eye trouble about two weeks before. A tonsillectomy was done under local anaesthesia with uneventful recovery.

She was seen again Oct. 26, 1921, while visiting the city. The circumference of the thyroid had decreased to $13\frac{1}{2}$ inches; her heart rate was 90 per minute; no tremor of the outstretched hands. Her exophthalmos is still the same; the right palpebral fissure is now of the same width as the left; the right pupil dilates when shaded; the cornea cannot be indented or wrinkled by the probe. She states that she has had no photophobia or ocular pain since the tonsillectomy. Although ordered to report regularly the state of her gland and the condition of her eye the patient left town to teach and we have since lost trace of her.

Here then, briefly, we have a thyrotoxic patient, a sufferer from infected tonsils, who exhibits an irregular periodic softening of the eyeball on the side of the greatest degree of glandular enlargement, who reveals no other cause for the intermittent minus tension that can be demonstrated anatomically or clinically, and who not only reports a marked subsidence of the thyrotoxic symptoms after tonsillectomy, but also the disappearance of the periodic attacks of ocular trouble.

Therefore we designate this case—and we believe with much justification,—as one of intermittent ophthalmomalacia. The term is to be restricted to that condition characterized by periodic softening of the eye, in which we can find no *aetiological* factor in the ball itself, such as retinal detachment, phthisis following trauma, iridocyclitis, or panophthalmitis. At intervals the eye becomes markedly soft, with a little injection, a little photophobia, a little pain, perhaps, but the symptoms are not marked and the condition soon subsides, the vision remaining as good as ever. Intermittent ophthalmomalacia was first described by von Graefe, and the causes are in most instances as obscure and unknown as they were then. Most authorities dismiss the subject with the statement that injuries of the neck, tumors of the upper part of the chest or posterior mediastinum, or enlarged thyroid or lymphatic glands are probable causal factors in some instances. In the majority of cases of intermittent ophthalmomalacia where the cause is known, the *aetiological* factor has been found to be an enlarged thyroid which becomes swollen from time to time and so produces a pressure paresis of the sympathetic nerve on the side affected, the effects of the paresis disappearing with the subsidence of the extra amount of swelling.

Clinical as well as experimental evidence has given us a fairly definite train of ocular symptoms as indicative of sympathetic nerve paresis. The ptosis of the upper lid due to the paresis of the superior palpebral muscle which is supplied by the sympathetic; the contraction of the pupil because the parasympathetic dilatator allows the sphincter muscle to preponderate; the sinking in of the eyeball from paresis of Mueller's orbital muscle which normally aids in preventing recession of the globe; the decrease of ocular tension sometimes found accompanying the foregoing signs: all these phenomena we now know to be

definitely characteristic of sympathetic nerve paresis. In our case two ocular features are worthy of attention as having a probable bearing on the cause of the exophthalmos and the widening of the palpebral fissure found in hyperthyroidism. Landström and others dispute the theory that the exophthalmos in Basedow's disease is due to a dilatation of the orbital vessels and prefer to ascribe it to a tonic contraction of the smooth fibers of the orbital muscle which are supplied by the sympathetic. In our case, however, the sympathetic was paretic and yet the exophthalmos was not less in the right eye than in the left, this fact making it appear, therefore, extremely unlikely that the exophthalmos is due to tonic contraction of the orbital muscle to any marked extent—if at all. Apropos of the gaping of the palpebral fissure found in hyperthyroidism we have had a number of theories offered, the foremost being the theory of increased tonicity of the levator advanced by Moebius and the theory of tonic contraction of the smooth superior tarsal muscle supplied by the sympathetic. It is probable that both are important factors in the production of the gaping palpebral fissure, for in our case in which the sympathetic exhibited the signs of intermittent pressure paresis, although we found the right fissure less wide than the left still the gaping was too great in extent to be accounted for by the proptosis alone, and so Moebius' increased tonic levator contraction was probably also present.

The consideration of the chain of events in this case brings us face to face with the following facts. The favorable effect exerted by the tonsillectomy on the whole process indicates the probability of the tonsils being at the bottom of the whole trouble. We believe the tonsils acted as infective foci to produce a perverted condition of the thyroid gland, this glandular involvement being attended by characteristic enlargement and both general and ocular symptoms. The attacks of intermitting ophthalmomomalacia were evidently brought on by the periodic swelling of the large thyroid, the eye being affected on the side with the greater thyroid enlargement because it was on that side only that the periodic increase in size permitted pressure on the sympathetic.

THE SIGNIFICANCE OF MOLLUSCUM CONTAGIOSUM AS AN ÆTILOGICAL FACTOR OF CONJUNCTIVAL AND CORNEAL DISEASE.

BY PROF. ANTON ELSCHNIG, PRAG, CZECHO-SLOVAKIA.

RECENTLY H. and S. R. Gifford reported six cases in which mollusca contagiosa located at the lid border were proven to be the ætiological factor of a long-standing chronic conjunctivitis. Reference was made to the few reports that had appeared in the previous literature. In reality, the ætiological significance of molluscum contagiosum in cases of conjunctivitis has been known but a comparatively short time, and to de Wecker belongs the credit of having recognized it first. In 1897, I published seven cases, one of whom I had had under observation for four years. In six of these cases there was a chronic conjunctivitis, with multiple follicle formation that so closely resembled a trachoma that the diagnosis of trachoma had been made elsewhere and treatment for that condition begun. The seventh was a simple chronic conjunctivitis. In all of these the diagnosis of molluscum contagiosum was confirmed by the anatomical examination and in all of them, the conjunctivitis disappeared following the extirpation of the molluscum. At that time, I expressed the opinion that the influence of the molluscum upon the conjunctiva was partially a reflex, and partially a mechanical irritation due to extruded molluscum cells. In support of the first view may be mentioned the rather common observation that frequently a chronic conjunctivitis is continued by the presence of small papillomata at the roots of the cilia and can be relieved only by the removal of such. The second view is confirmed by the undoubted infectious character of the molluscum.

In a later communication, I was able to show that molluscum of the lid margin may lead not only to a conjunctivitis, either with or without a trachoma-like follicular hypertrophy, but also to a conjunctivitis or even a keratitis of a phlyctenular or eczematous character. The latter is merely further proof that an irritation, which in a normal individual would be followed simply by a conjunctival inflammation, may cause a typical phlyctenular affair in an individual so predisposed (exudative diathesis). A diagnostic tuberculin injection may be followed by an acute phlyctenular disease in the same manner, just exactly as a simple inflammation of the conjunctiva due to pneumococcus or Koch-Weeks bacillus, may cause the outbreak of a phlyctenular kerato-conjunctivitis in the individual so predisposed. In those cases, the removal of the molluscum is essential for the relief of the phlyctenular disease.

In the Clinic we see about ten thousand cases a year and among these, there will be four cases of molluscum contagiosum so that in each semester it is possible to demonstrate one or two cases.

REFERENCES.

- H. and S. R. GIFFORD. "Molluscum Conjunctivitis." *ARCH. OF OPHTHAL.*, 1., No. 3.
A. ELSCHNIG. "Molluscum Contagiosum und Conjunctivitis Follicularis." *Wiener Kl. Wochenschrift*, 1897, No. 43.
A. ELSCHNIG. *Prager Med. Wochenschrift*, 1908, No. 11.

PRIMARY INTRANEURAL TUMORS (GLIOMAS) OF THE OPTIC NERVE.

A HISTOLOGIC STUDY OF ELEVEN CASES, INCLUDING A CASE SHOWING CYSTIC INVOLVEMENT OF THE OPTIC DISK, WITH DEMONSTRATION OF THE ORIGIN OF CYTOID BODIES OF THE RETINA AND CAVERNOUS ATROPHY OF THE OPTIC NERVE.¹

By DR. F. H. VERHOEFF, BOSTON, MASS.

(Concluded from March number.)

COMMENT.

Case 1 shows one feature which has not hitherto been observed, namely gliomatous involvement of the optic disk and retina with formation of prepapillary cysts. Contrary to what might have been expected, the involvement of the disk was not due to direct extension of the tumor from the nerve stem through the lamina cribrosa, for, as a matter of fact, the portion of the nerve within and just behind the lamina was of almost normal thickness, but obviously to proliferation of the preexisting neuroglia of the disk. The occurrence of cysts in such tumors has been repeatedly observed and the cysts on the disk in this case are unique, therefore, only as regards their situation.

From a clinical standpoint also the case is unusual in that the larger cyst of the disk was recognized as such on ophthalmoscopic examination, and in that there was a definite record of normal vision in the eye, antedating the onset of exophthalmos for years. At the first ophthalmoscopic examination, the

¹ From the Massachusetts Charitable Eye and Ear Infirmary.

appearance was that of ordinary papilloedema. This later became more marked and then apparently subsided somewhat. Two years elapsed previous to the last ophthalmoscopic examination so that the development of the cyst could not be followed. Whether or not the appearance of papilloedema was from the first due to gliomatous involvement of the disk it is impossible to determine.

Gliomatous involvement of the disk apparently also existed in Case 2, but in an early stage.

In the literature I have found only one case of glioma of the optic nerve, that reported by Sulzer and Rochon-Duvigneau,¹ in which the optic disk possibly showed gliomatous involvement. In this case a tumor of the disk was seen ophthalmoscopically and taken to be a cyst; but on microscopic examination the disk was found to be replaced by a solid vascular growth. The authors do not state that the latter was composed of neuroglia, and their description of it is too brief and inadequate for any definite conclusion to be drawn as to its nature.

Case 4 is especially noteworthy. In this case, four years after removal by Dr. de Schweinitz of a tumor of the orbital portion of the optic nerve, which I find to be a typical glioma, symptoms of a tumor of the hypophysis developed, and at a second operation a tumor of this body was actually found and partly removed. Sections of the hypophysial tumor which I examined, show it to be a typical glioma arising from cells of the pars nervosa. A possible relationship between the two tumors is suggested below. Case 10 is unusual in the occurrence within the tumor of numerous cells resembling ganglion cells. These cells were regarded as true ganglion cells by Dr. Ewing and Dr. Meeker, but for reasons given in my description of the case, I regard them as neuroglia cells. In Case 7 the tumor was unusually large and contained unusually large cysts, markedly dilated veins, some of which contained fibrinous thrombi, large interstitial hemorrhages, and an unusual abundance of cytid bodies.

The tumor in Case 9 presents one feature not present in any of the others, namely, a large area of hyaline necrosis

¹ Sulzer et Rochon-Duvigneau: "Neoplasme du nerf optique et de la papille," *Ann. d'ocul.* cxlix., 161, 1913.

containing numerous corpora amylacea. In the vicinity of this area are many endothelial phagocytes, some of which have formed foreign body giant cells.

All of these tumors are sufficiently similar as to leave no doubt that they are all of the same nature, yet no two of them are exactly alike in structure. The differences between them are chiefly quantitative, that is, generally speaking, the same elements can be seen in all of the tumors, but in different proportions and arrangements. That they are all composed primarily of neuroglia is sufficiently obvious even without the use of differential stains. When a portion of the normal or relatively normal nerve is present in the specimen, the transition of the normal neuroglia into that of the tumor proper is apparent at a glance. The results, however, obtained by the use of Mallory's neuroglia stain in five cases (Cases 1, 2, 6, 9, and 10), in which the tumors included all the different types of tissue encountered in the other tumors, leaves no doubt as to the gliomatous nature of all these tumors. In the other cases the fixation was unsuitable for the use of the neuroglia stain.

While the histologic structure of most of these tumors at first appears rather complicated, yet it seems to me possible to recognize three main types of tissue in them. Any one type may undergo transition into either or both of the others. The first which, for lack of a better term, I shall designate the finely reticulated type, is similar to, but not identical with, that of the neuroglia of a normal optic nerve (Figs. 7 and 8). It consists of a matrix of fine fibrils running in the interspaces of a delicate cell reticulum, embedded in which are small round or oval nuclei. The fibrils may run irregularly or all in the same general direction. The reticulum may be so delicate as to be scarcely recognizable, or it may be quite definite. The tissue is usually marked off by connective tissue septums into definite spaces as in the case of a normal nerve, but sometimes occurs in irregular and less well defined masses. The nuclei may be scanty or abundant, and regular or irregular in size. They are generally surrounded by only a small amount of cytoplasm, which stains feebly and generally contains small vacuoles. Occasionally cells occur, however, which have a considerable amount of cytoplasm, eccentrically placed nuclei, and long processes which give them considerable resemblance

to ganglion cells. Such cells are present in Cases 9 and 10, being especially abundant in the latter, and for reasons given in the description of these cases, I regard them as undoubtedly neuroglia cells.

The second type of tissue, which I shall designate the coarsely reticulated type, seems to be simply an exaggeration of the first type (Figs. 4 and 10). The nuclei are similar, but the reticulum of the syncytium much coarser, and vacuolization of the cytoplasm is extremely marked, producing appearances resembling those of a myxoma. Fibrils are coarser and fewer in number than in the first type. This tissue has a special tendency to form cystic spaces, often of large size. It is well exemplified by the extraneural portion of the tumor of Case 8, and it was no doubt upon the appearance of this tissue that Salzman based his diagnosis of myxosarcoma in this case.

The third type of tissue I shall designate the spindle-cell or coarsely fibrillated type. This consists of coarse neuroglia fibrils, many of which are partly spiral in form, between which lie neuroglia cells. The latter are, generally, so-called spindle cells, and these may be so abundant as to make the tissue closely resemble that of a spindle-cell sarcoma (Figs. 5 and 9). The cells are often similar to the spindle cells which occur in a normal optic disk just anterior to the lamina cribrosa and which Nikolai regarded as smooth muscle fibers.¹ Occasionally, most of the cells are similar to those of Type 1. The fibrils are generally arranged in fairly definite bundles. The cells form a vacuolated syncytium with lateral communications between which the fibrils run, so that when the bundles are seen in cross section they present an appearance more or less similar to the tissue of Type 2. When, therefore, the bundles run very irregularly so that many of them are seen in cross section, two types of tissue may appear to be present whereas this is not the case. Without special staining the longitudinal bundles might be, and no doubt often have been mistaken for, connective tissue stroma. When stained differentially, the neuroglia fibrils appear to be more abundant in this type of tissue than in the others, but this may be due to

¹ Verhoeff, F. H.: "Some Remarks on the Use of Mallory's Phosphotungstic Acid Hematoxylin, and a Note on the Musculus Papillæ Optici of Nikolai," *Roy. Lond. Ophth. Hosp. Rep.*, xv., 4, 1903.

their being more conspicuous. This type is well exemplified by the tumors in Cases 2 and 11, in which it was the only type of tissue present. In some cases, as in Case 9, in areas in which there is rather abrupt transition from Type 1 to Type 2, there is a marked tendency for the spindle cells to arrange themselves radially to the connective tissue septums. The spindle-cell type of tissue also tends to occur in close relation to the connective tissue stroma. When the tumor invades the latter, as it often does, or the pia and dura, the invading tissue is practically always of this type, and is often so intermingled with the connective tissue elements that without special staining its true nature may escape recognition. Case 10 is unusual in that the spindle-cell type of tissue occurs in the interseptal spaces, while the coarsely reticulated type occurs along and within the septums.

None of the types of tissue just described closely resemble the tissue of an embryonic optic nerve at any stage, but Type 1 somewhat resembles the syncytium of an embryonic optic disk at an early stage, while Type 3 is somewhat similar to the tissue of the embryonic nerve stem. The embryonic optic nerve at this stage, however, does not contain any fibrils which stain differentially in the neuroglia stain. Tissue, identical with that of Types 2 and 3, often results from hyperplasia of the neuroglia of separated retinae which occur under inflammatory conditions.

In none of these tumors can I find any neuroglia nuclei in the process of either direct or indirect division, owing, no doubt, to the very slow rate of proliferation. In sections of the five tumors stained in Mallory's neuroglia stain, all of the tumor cells show centrosomes, each containing two dots, and no cells are to be found containing centrosomes with multiple dots such as are seen in ependymal cells and some of their derivatives. Occasionally, some of the tumor cells contain hematogenous pigment. In no case do the tumor cells tend to become free and infiltrate the tissues.

A feature of these cases deserving some comment is the proliferation of the arachnoid tissue which often takes place, especially at the anterior end of the subdural space. It is marked in Cases 1, 2, 3, 7, and 9. In the other cases the sections did not include this part of the nerve. The new tissue is

easily recognizable as arachnoid tissue, although it is often atypical. In places the stroma in the form of hyaline strands predominates, while in others the cellular elements do so. When this tissue is invaded by the tumor, as in Cases 1, 2, 3, and 7, there naturally results complicated appearances, which when seen in sections tangential to the nerve, might lead to a diagnosis of endothelioma. In Case 7 the arachnoid had produced large hyaline areas which had been surrounded and invaded by the tumor so as to produce appearances not unlike those of an epithelial cylindroma. The cause of this arachnoid proliferation I take to be purely mechanical, namely, the distention of the subdural space and the consequent strain of long duration thereby put upon the arachnoid trabecula. That such distention, if long continued, is sufficient to cause marked proliferation is almost certain, for I have observed it in cases of orbital tumors not connected with the nerve, which had produced papillœdema. The possibility that some stimulating influence from the glioma is a contributory factor is not absolutely excluded, but is unlikely from the fact that these tumors show no special tendency to stimulate other connective tissue even when in direct contact with it.

A question of special interest relates to the mode of origin and growth of these tumors. Most tumors occurring elsewhere evidently arise from a small focus and increase in size by continuity of growth, pushing aside or invading the contiguous tissues. In the case of the tumors under consideration, the growth does not increase in size by invading or destroying the original nerve structure, but by causing the preexisting neuroglia in the vicinity of the growth to proliferate. In longitudinal sections which include a portion of the uninvolved nerve, the gradual transition of the normal neuroglia into that of the tumor is most obvious. In some cases, such as Case 1, it is only when the growth invades the subdural space, where it meets less resistance, that the neuroglia takes on a markedly abnormal character. It is noteworthy also that in this case, in which the retina was involved, the retinal hyperplasia involved only the preexisting neuroglia and tended here to produce tissue of a relatively normal character. These facts seem to show clearly that either some abnormal stimulating factor or, less probably, the lack of some normal inhibitory

factor, has existed in the affected portion of the nerve and retina. Possibly such a stimulating factor is supplied in increasing abundance by or from the actively proliferating neuroglia of the tumor. This would best explain the proliferation of the neuroglia of the disk and contiguous retina in the case referred to, and perhaps also the glioma of the hypophysis in Case 4. It would also explain the notable fact that in the literature there is no record of a single case in which recurrence of a glioma of the optic nerve has taken place, although in many, if not most, of the cases the removal has been incomplete.

Since the preceding was written, I have found that Councilman¹ has come to similar conclusions in regard to gliomas of the brain. He states: "The advance of the tumor is preceded by a general proliferation of the neuroglia cells which become converted into cells of the tumor and have the growth and form characteristic of these. . . . It is impossible to avoid the impression that in the tumor, or in some way associated with it, a substance is produced which stimulates the neuroglia to growth; this growth taking the form both of general gliosis and of tumor."

The fact that the great majority of these tumors of the optic nerve manifest themselves early in life suggests that they are really congenital in origin and due to some more or less localized abnormality in the embryonic development of the neuroglia of the nerve. A tumor having once begun from such a congenital "anlage" might be partly or wholly dependent for its further development upon the stimulating factor just hypothesized. This possibility is not excluded by the fact that in Case 1 there was normal vision in the affected eye at the age of 10 years, since it is not necessary to assume any defect in the formation of the optic nerve fibers.

As already mentioned, Hudson did not regard these tumors as true gliomas, but preferred the designation "degenerative gliomatosis, implying a generalized overgrowth of neuroglia tissue of infiltrative character, dependent on some degenerative change in the tissues of unknown ætiology." He apparently based his view entirely on the fact that they do not recur after

¹ Councilman, W. T.: "Anatomical Consideration of Tumors of the Brain with Special Reference to the Gliomata," *Colorado Med.*, xii., 289, Oct., 1915.

incomplete removal. Since we do not know the cause of gliomas of the brain, this term does not necessarily indicate any essential difference between many gliomas of the brain and these tumors of the optic nerve and I therefore see no reason for its adoption. In my opinion, the facts that these tumors of the optic nerve are composed primarily and almost exclusively of neuroglia, that they invade the connective tissue stroma, penetrate the pia, and grow exuberantly and atypically in the subdural space, and are histologically similar to many gliomas of the brain and spinal cord, are alone sufficient grounds for regarding them as true gliomas.

While certain types of glioma of the brain are similar to gliomas of the optic nerve, other types frequently occur in the brain, which are markedly dissimilar to any of the optic nerve tumors. Such tumors of the brain contain elements which are more closely related to those of the embryonic neural epithelium, and are, perhaps, derived from persisting remnants of this epithelium. Since the optic nerve, so far as I know, never contains ependymal cells or remains of the embryonic neural canal, it is not surprising that the tumors arising from it never contain structures, such as rosettes, which suggest a derivation from these elements.¹ For a similar reason, tumors of the optic nerve would not be expected to contain ganglion cells.

Since these tumors of the optic nerve in their gross appearances bear considerable resemblance to neurofibromas of the peripheral nerves, it is not surprising that attempts have been made to prove that they were of the same nature or were dependent upon similar causes. Goldman,² who made the first attempt in this direction, and later Byers,³ based their arguments chiefly on the assumption that the tumors of the optic nerve were composed primarily of mesoblastic tissue and were therefore histologically similar to neurofibromas. Now that

¹ Sulzer and Rochon-Duvigneau (*Ann. d'Ocul.*, cxlix., 161, 1913) mention epithelioid masses resembling rosettes as occurring in the tumor referred to above; but from the meager description given it is impossible to determine whether or not they were analogous to the rosettes occurring in tumors of the brain.

² Goldman, E. C.: "Beitrag zu der Lehre von den Neuromen," *Beitr. z. klin. Chir.*, x., 13, 1893.

³ Byers: "The Primary Intradural Tumors of the Optic Nerve," *Studies from the Royal Victoria Hospital*, Montreal, 1901.

we know that the tumors are composed essentially of neuroglia, this argument falls to the ground.

The possibility still remains, however, that the same influence which causes the supporting tissue of a peripheral nerve to proliferate in the form of a fibroma, may cause the supporting tissue of the optic nerve to proliferate in the form of a glioma. This theory was suggested by Emanuel,¹ who, however, regarded most of these tumors as mesoblastic in origin. The only important evidence he brought forward, consisted of the facts that in one of his cases the father of the patient was affected with fibroma molluscum, that there was a history of the same condition affecting his grandfather, and that a brother was affected with pigmented nevi. If Emanuel's theory were correct, it would seem that among the numerous cases of glioma of the optic nerve that have been reported in the literature, in at least one case the two conditions should have co-existed. Moreover, as Hudson points out, "the existence of multiple isolated tumors of the optic nerve, which Emanuel adduces in support of his theory, has apparently never been conclusively demonstrated by microscopic examination."

VACUOLIZATION AND CYST FORMATION IN GLIOMAS OF THE
OPTIC NERVE AND THEIR SIGNIFICANCE IN REGARD TO
CAVERNOUS ATROPHY OF THE OPTIC NERVE.

Vacuolization is such a marked characteristic of neuroglia cells, and particularly of the cells in these tumors, that it is worthy of special consideration, although it is not, of course, peculiar to neuroglia cells. It is, for example, a striking characteristic of the cells of the notochord and of tumors arising therefrom. In all of the tumors of the optic nerve stem, which I examined, it was a well-marked feature, although more so in some than in others. In the tumors reported in the literature it evidently was equally as marked, although it was not recognized as such and was frequently mistaken for myxomatous degeneration. Thus in fifty-four out of the 118 cases collected by Hudson, the tumor was regarded as partly or wholly myox-

¹ Emanuel: "Ueber die Beziehungen der Sehnervengeschwülste zur Elephantiasis neuromatodes und über Schnervengliome," *Arch. f. Ophth.*, lxxii., 129, 1902.

matous in nature, and of these, thirty-five were reported as myxosarcomas. It is noteworthy, moreover, that not a single observer reported a positive test for mucin.

In studying sections of these tumors, I find that the process of vacuolization occurs in all types of neuroglia cells, and I have gathered the impression that it is upon this process that the formation of the delicate communications between neighboring cells depends, or in other words, that the reticulated syncytium characteristically produced by neuroglia cells, is dependent upon a process of vacuolization, the minute spaces between the trabeculae representing vacuoles within the syncytium, and the larger spaces vacuoles which have broken into one another. I have also frequently observed identical appearances in the glia tissue formed by separated retinas under inflammatory conditions, and in diffuse gliomas of the brain.

I find also that the cysts which frequently occur in these tumors and also in diffuse gliomas of the brain are obviously due to a further extension of the process of cell vacuolization. The smaller spaces and vacuoles break into one another, and in this way form cysts of various sizes. This process is well shown in Figure 4, where the vacuoles in the surrounding cells can be seen in actual communication with the cyst cavity. It is conceivable, of course, that cysts of a different origin may occur in these tumors; but I have never encountered them.

The original contents of the vacuoles and spaces is a matter of conjecture. In the sections, most of the spaces are apparently empty, only a few, and these comparatively large, containing dilute serum. They were, therefore, originally filled with fluid which has diffused out in the preparation of the specimens. Since after fixation, no albuminous precipitate or coagulum has been left, the fluid may have been similar to cerebrospinal fluid. In Case 7, however, it is noteworthy that the trabeculae around many of the spaces are coated with fine granules and threads, stained deeply in hematoxylin. I have seen similar granules on the trabeculae around the cavernous spaces in optic nerves of glaucomatous eyes, and also on the trabeculae around the cystoid spaces frequently found in the retina near the ora serrata in senile eyes. It is possible that these may consist of mucin; but even if this should be true, it would be improper, or at least misleading, to designate the

tissue myxomatous, since it is not mesoblastic in origin. The cystic cavities, and many of the larger spaces in the tumors, contain serous coagulum of various degrees of density, similar to the serous fluid which collects beneath separated retinas. This serum is evidently not derived from the cell vacuoles, but is exuded more directly from the blood vessels into the spaces and cysts. Some of the cystic spaces also contain red blood corpuscles. In Figure 4 it will be noted that while the cyst cavity proper is filled with serum the surrounding cell vacuoles are apparently empty.

By comparing sections of optic nerves showing cavernous atrophy with sections of these tumors, I find that in the latter the exact picture of a glaucomatous cup surrounded by cavernous spaces often occurs. On the trabeculae around the cavernous spaces of the optic nerve, as noted before, I have occasionally also found basophilic granules as in Case 7. It is evident, therefore, that the cystic spaces occurring in cases of cavernous atrophy of the optic nerve are due to a natural tendency of neuroglia to produce cysts. In other words, they are due to hyperplasia of the neuroglia of the nerve and not primarily to degeneration, as has been assumed. I do not, however, concur in the view of Schnabel that the main glaucoma cup itself is formed by cavernous spaces breaking into one another, because the excavation of the disk frequently takes place before cavernous spaces in the nerve are produced.

THE ORIGIN OF CYTOID BODIES.

Another feature of these tumors requiring further consideration is the occurrence of cytoid bodies within them. These bodies undoubtedly have previously been seen by other observers, generally being described as hyaline masses occurring within or between the tumor cells, but their identity with the cytoid bodies occurring in the retina under various pathologic conditions has not hitherto been recognized. The latter have been regarded as varicose nerve fibers, degenerated ganglion cells, and degenerated neuroglia cells, by different observers. Since in these tumors the bodies present all the various appearances shown by cytoid bodies of the retina in albuminuric retinitis and other conditions, and since in both situations the

tissues in which the bodies mainly occur, namely, the nerve fiber layer of the retina, and tissue derived from the optic nerve stem, are similar in nature, there seems to be no escape from the conclusion that the bodies in the two situations are identical. As it has hitherto been impossible to ascertain the origin of cytoid bodies in the retina, owing, no doubt, to their scarcity in any one case, I have attempted to ascertain their origin in these tumors in which they are often abundant.¹

At the outset, the possibility of their being varicose nerve fibers can be excluded by the fact that they are likely to be especially abundant in the subdural portion of the growths where nerve fibers have never existed, while an origin from ganglion cells is excluded by the fact that there are no definitely recognizable ganglion cells in the tumors.

As seen in these tumors, the cytoid bodies when small are often round, and rarely encapsulated. The larger ones are generally elongated and highly irregular in shape (Figs. 10 and 11), and sometimes roughly sausage shaped, seldom pyramidal. The largest may attain a cross diameter of .025mm, and they may reach a length of .10mm. The thickest are not usually the longest. None of the bodies contains definite nuclei, although occasionally, after alum hematoxylin staining, some resemblance to a nucleus is produced by a portion of the substance staining more deeply than the rest. These pseudonuclei never show nuclear membranes or contain chromatin nets or nucleoli.

The bodies stain intensely in eosin, acid fuchsin, or carbolfuchsin, and under moderate magnification, they usually appear uniformly hyaline; but sometimes they consist of large hyaline balls. After Zenker's fixation, they stain intensely black in phosphotungstic acid hematoxylin, and when then seen under the oil immersion lens they always appear more or less granular. Frequently their bodies are continued into long processes, which in some instances are fairly coarse, but in others extremely delicate. Some of these processes stain like neuroglia fibrils throughout, others stain only along short stretches, or show granules along their borders.

In a few instances, a process after becoming unstained can

¹ In several diffuse gliomas of the brain, selected at random, I have found these bodies present, and in one tumor, abundant. General pathologists have evidently given them little attention.

be traced into connection with a neuroglia cell. As a rule, however, no such connection can be made out, and as the fibril is followed, it either appears to end abruptly, or to stain so feebly and to become so ill defined that its relation to a nucleus cannot be demonstrated.

In Case 1, in the thickened retina, near the tumor of the disk, where the neuroglia has a comparatively normal arrangement, the formation of cytoid bodies can be definitely traced. The earliest indication of one consists of a swollen portion of a cell process, filled with large eosinophilic granules (Fig. 12). This process is connected chiefly with one cell lying distant from it, but has communications with other cells also. In other words, cytoid bodies are formed within the trabeculae of a neuroglia syncytium. In the early stages, the eosinophilic material does not stain so intensely as it does when it has become more abundant, so that it probably undergoes further chemical changes as it becomes older.

As these bodies stain differentially by Mallory's neuroglia method, and are frequently in continuity with fibrils indistinguishable from neuroglia fibrils, they can, perhaps, be looked on as atypical or giant neuroglia fibrils. Careful study shows that the stainable substance is deposited first in the form of irregular granules just beneath the cell membrane of the process. These increase in number and size until they completely fill the processes for a certain distance. The large cytoid bodies evidently result from distention of the cell processes by excessive accumulation of the stainable substance. For if enlargement of the process occurred first and the deposit of stainable material later, it should be possible to find such unstained swollen process in various stages of development. As a matter of fact, no swollen processes incompletely filled with stainable material can be found.

CLINICAL FEATURES

The clinical features associated with gliomas of the optic nerve have been fully described by Hudson. He found the tumors were more frequent in the female sex in the ratio of about 7 to 4, and that they occurred within the first decade of life in about 75 per cent. of the cases. In one case, the tumor

occurred as late as the sixtieth year. Hudson considered injury of considerable importance as a predisposing cause; but to me his evidence on this point is not convincing. Exophthalmos was of very slow development, the eye, as a rule, being protruded painlessly in the direction of the orbital axis. Limitation of ocular motion was generally not marked, but occasionally was complete. The optic disk usually showed evidences of papilloedema or optic atrophy. Vision was usually affected before the onset of exophthalmos, and was almost always completely abolished at the time of operation; but in one case it was said to have been normal, and in two others very slightly affected. Hudson gives no data regarding the frequency of occurrence of these tumors; but that they are extremely rare is indicated by the fact that only three such tumors have been removed at this institution within twenty-seven years.

In no case, except my Case 1, has the tumor certainly involved the globe itself. In the cases collected by Hudson, which came to necropsy, fifteen in number, more or less intracranial involvement was found in all, indicating that this is to be expected in at least the majority of cases. As Hudson points out, "The large size attained by the cerebral new formations without the production of severe symptoms has in several cases been very remarkable and is to be attributed probably to the very slow rate of increase." No case has yet been recorded in which the tumor has been confined to the intracranial portion of the optic nerve. Should such tumors occur, possibly they may show characteristics somewhat different from those of the tumors of the intraorbital portion. In many, if not the majority, of cases, the removal of the orbital tumor has been incomplete, yet recurrence in the orbit has never been recorded, although cases have been followed from two to twenty-four years.

As regards operation, Hudson advises removal of the tumor without the globe, if possible, through the soft tissue, except perhaps when there is still some vision and the diagnosis is doubtful, in which case Krönlein's operation is probably to be preferred. Complete removal is often impossible, owing to the frequency of intracranial involvement. Death from meningitis has resulted from operation in about 10 per cent. of the cases.

Considerable interest has been aroused by the marked pigmentary changes in the fundus, which generally follow removal of a tumor of the optic nerve without the globe. I have examined microscopically an eye in which the optic nerve had been cut several years previously in order to relieve the annoying diplopia resulting from a strabismus operation. In this case, there was extreme atrophy of both the choroid and retina, with pigmentation of the latter by cells migrating from the pigment epithelium. Since obstruction of the central vessels alone does not lead to such changes, it is evident that they resulted in this case from section of the posterior ciliary arteries and that the same explanation undoubtedly applies to the cases under discussion.

The occurrence of retinitis proliferans, after removal of the tumor without the globe, as in Case 5, is distinctly unusual, surprisingly so, in fact, in view of the marked interference with the retinal circulation which must result from such operations.

CONCLUSIONS

1. The most common tumors of the optic nerve are gliomas. These are the only primary intraneurial tumors of this nerve that have been observed.
2. These tumors are composed of three main types of neuroglia which may grade into one another. Some tumors consist of all three types; rarely does one consist of a single type. Tumors in which so-called spindle cells predominate contain the largest and most conspicuous neuroglia fibrils.
3. The spongy structure often displayed by these tumors, which at times has led to a diagnosis of myxoma, myxoglioma, or myxosarcoma, is not the result of myxomatous degeneration, but is produced by excessive vacuolization of a neuroglia syncytium. Cysts of various sizes, which also often occur in these tumors, are due to the same process.
4. The tumor is probably essentially congenital in origin and dependent upon some abnormality in the embryonic development of the neuroglia of the optic nerve. The growth stimulates proliferation in all contiguous neuroglia tissue and thus causes the latter to take on the character of tumor tissue. In one case, the tumor in this way caused marked gliomatous

involvement of the optic disk and of the retina surrounding the latter. In another case, a glioma of the optic nerve was associated with a glioma of the *pars nervosa* of the pituitary body.

5. The theory that tumors of the optic nerve stem are related in origin to neurofibromas of the peripheral nerves is, at present, founded on insufficient evidence, but cannot be dismissed as impossible.

SYMPATHETIC OPHTHALMIA: REPORT OF TWO CASES CURED.¹

By DR. DERRICK T. VAIL, CINCINNATI, OHIO.

SYMPATHETIC ophthalmia is insidious and silent in its onset, its progress is steadily onward, the results of treatment are disappointing in the vast majority of cases and the prognosis from its start is bad, so that cured cases when encountered should be tabulated and reported.

The literature on this disease where, in spite of excellent treatment blindness has supervened, makes gloomy reading.

To encounter two cases within six months' time in each of which a complete cure was accomplished is indeed a rare experience. In reading the notes of such cases we naturally wonder if the disease was genuine, and are inclined to feel that it may have been ocular syphilis, or uveitis or toxemic plastic iritis and not the true *Sympathetic Ophthalmitis*.

It would be well if we would formulate and agree upon certain definite clinical findings which must invariably be present in order to establish a correct diagnosis.

A positive diagnosis can be made in the laboratory from microscopic examination of the enucleated specimen but it is more important to be able to definitely diagnose the disease *in vivo* from early clinical manifestations.

It seems that the following clinical triad of objective findings must exist in order to establish an undoubted diagnosis:

I. A penetrating injury of one eyeball² followed by a lack

¹ Read before the first meeting of the Cincinnati Ophthalmological Club, Cincinnati, Ohio, December 9, 1921.

² An incision for the performance of cataract extraction or iridectomy fulfills this requirement as well as an accidental perforating injury.

of healing response, which is manifested by a quiet iritis and a disposition to wandering or detaching pigment cells from the uveal pigment of the iris, along with the formation of profound posterior synechia and absence of severe pain in the injured eye.

- II. The presence of systemic anemia.¹
- III. The appearance in the fellow eye of the following:²
 - (a) Quiet iritis with rapidly forming circular synechia,
 - (b) Plastic optic neuritis and retinitis, and
 - (c) Minus tension as demonstrated by the tonometer.

The following two cases presented all these phenomena and I feel certain the diagnosis in each was correct.

CASE 1.—On December 14, 1920, S. B., white, male, age thirty-three years, farmer, enjoying robust health, while at work on his farm cutting nails to detach boards from fence posts and while using a hatchet as a chisel held in his left hand and a hammer in his right, felt something hit him in the left eye. There was instant pain followed by blindness.

Examination seven hours after the accident:

There was a horse-shoe-shaped oblique perforating wound present in the left cornea opposite the upper surface of the iris. The iris behind this was torn, the lens was cataractous.

Operation: The wound of entrance was slightly enlarged with scissors. The giant magnet was applied and a large fragment of iron was drawn from the depths of the vitreous chamber and extracted through the wound. The torn and herniated iris was carefully abscised and the wound neatly dressed after a thorough cleansing with $\frac{1}{10}$ per cent solution bichloride mercury. The patient was put to bed at once and wet compresses were applied for the balance of the night.

The eye did not do well. There was, of course, marked inflammatory reaction. Wound infection and plastic iritis developed within three days, followed by glaucoma after three more days. As there was from the first no light perception present in the injured eye the patient was advised to have it enucleated. This he stoutly refused to permit.

Iridectomy near the wound was performed on the seventh day after the injury to relieve tension and the galvano cautery was employed at the same time to the lips of the infected

¹ This term is used to express a systemic impression that is invariably present in this disease, an impression characterized by palor and adynamia.

² These sympathizing symptoms rarely appear in the second eye before the seventh and usually after the tenth day following the traumatism.

wound. These measures did not bring about an improved state of affairs and the patient was again urged to submit to enucleation as a safeguard against sympathetic ophthalmia, but he again refused stating he would return home to spend the Christmas holidays with his family and return later on. At this time his right eye was normal to all tests.

He returned to see me after an interval of two weeks. The injured eye was entirely blind, soft, wrinkled, and sunken, the cornea was small, the iris was yellowish, and the anterior chamber was very deep. He made regular office visits after intervals of two weeks each, presenting the same unimproved appearance as regards the injured eye. At each of these visits the right eye was examined and found to be normal to all tests.

On March 29, 1921, over three months after the accident, I took a firm stand and told him it was positively dangerous to delay enucleation so long but he refused stating there was nothing wrong with his good eye and that he desired for esthetic reasons to retain his injured eyeball even if it was unsightly and dangerous.

I then told him if he noticed transitory attacks of shadows or "showers of soot" with his right eye he should come to see me at once.

On April 11, 1921, two weeks after this or four and one-half months after the accident he came in an excited state of mind because he had experienced two attacks of momentary blindness of his right eye the day before and it frightened him to be blind like that even for a moment. He determined to have the injured eye removed at once, for on his way to Cincinnati he had had two more similar attacks, so that he could hardly wait but wanted the enucleation operation done at once.

I found the group of objective symptoms in the second eye mentioned in the beginning of this report—ring synechia was already established, neuro-retinitis was positively present. The dioptric media were slightly misty in appearance, the tension was 18mm, the vision was $\frac{3}{6}$, the fields of vision for white and colors were normal. There was no pain present but slight deep pericorneal injection was noticed with focal illumination aided by the binocular loupe.

I enucleated the first eye at once and ordered a brisk calomel purge followed by twenty-grain doses salicylate of sodium every four hours. The patient was kept in bed. A two per cent. solution atropine or a one per cent. solution of scopolamine was instilled alternately in the remaining eye every four hours for two days. The synechiae were thus all separated and the pupil became fully dilated and circular. The fundus likewise appeared improved and the

patient was permitted to return home after a week and was advised to repeat the calomel or castor oil purge twice a week together with the twenty-grain doses of sodium salicylate every four hours for three days out of every week.

He returned eleven days later with the remaining eye presenting a nearly-normal appearance, but on May 10, 1921, thirty days after enucleation, he returned again presenting the typical ocular picture of sympathetic ophthalmia. No symptom was lacking. The synechiae had reformed, the neuro-retinitis was again in evidence, the deep ciliary injection returned, the eyeball was soft (tension 16mm) and things looked bad indeed.

A Wassermann test was made and found to be negative. It was at this stage that I noted the extreme facial pallor of the patient. When he first came he was robust and rubicund; he now presented the striking picture of anemia and asthenia.

The patient was put to bed, atropine and scopolamine drops were used as previously, active eliminations with castor oil followed by epsom salts employed, and sodium salicylate in twenty-grain doses again used every four hours. In four days' time the pupil was again dilated fully excepting one synechia below which resisted all efforts to sever.

I consulted Dr. Faller of Cincinnati, an expert hematologist, to learn if salvarsan would have a beneficial effect in combating anemia of the kind the patient exhibited and if so whether it was safe to employ it in non-syphilitic patients. I had heard it had been used with benefit in such cases. He assured me that because of the arsenic content it would have a positive effect in improving and building up the red cells of the blood and that it would be safe to use it in half-sized doses. (0.15 gram.)

He was given this fractional dose of salvarsan intravenously. The effect was striking. In two weeks' time he returned with good color in his face and his eye was clear and bright, vision being normal. The salvarsan dose was repeated and in another two weeks the cure became permanently established. The patient took twenty-grain doses salicylate of sodium three times a day for three days out of each week for a month's time after the second and last dose of 606, and then, as he seemed well, he stopped it of his own accord.

I have seen this patient at monthly intervals for eighteen months after all medication was ceased and his eye remains entirely normal to all tests. The tension rose to 22 and 24mm and remains normal.

COMMENT: The above case was undoubtedly genuine, but it is difficult to determine exactly what brought about the com-

plete cure. Enucleation of the first eye within forty-eight hours after the disease announced itself in the second eye unquestionably removed the "storm center" but clinical experience has proven that enucleation alone has little effect upon curing the disease which has already started in the fellow eye. No doubt the salvarsan should have the credit of overcoming the anemia, and the elimination treatment employed, together with the medication with sodium salicylate, may have combated the toxic agent present in the blood.

CASE 2.—Mrs. O. H. F., housewife, age forty-seven, in rather delicate health on account of what seemed to be chronic toxemia or bacteremia associated with striking pallor of the skin of the face or, as called by former clinicians, "cachexia," came to see me on March 31, 1921, on account of an attack of fulminating glaucoma with much pain, redness of the eyeball and nearly total blindness of her left eye of less than twenty-four hours' duration. The tension of the left eye was 70mm as measured with tonometer. There was the typical picture of violent acute inflammatory glaucoma, e.g., steamy cornea, obliterated anterior chamber, fully dilated and fixed pupil, greatly impaired vision, chemosis and redness of the eyeball together with the typical severe pain affecting the upper branches of the fifth nerve.

There was a family history of glaucoma, for the patient's father had become blind from this disease, her uncle had also lost his vision presumably from chronic non-inflammatory glaucoma, and another uncle had gone blind from cataract "with complications," so that she was mentally prepared for the worst and seemed to be resigned to any fate.

The right eye was normal to all tests, vision $\frac{3}{5}$ without lenses.

Operation: Iridectomy, under local (subconjunctival) anaesthesia was successfully performed within twenty-four hours. As the result of this operation the tension fell to less than normal but an astonishing phenomenon resulted. The lens which from the high tension had been crowded against the posterior surface of the cornea, to which it seemed to be adherent, refused to return to its bed. It was dislocated in the anterior chamber. The iris fell back so that the *lower part receded behind the lower edge of the lens*. The pupil was fully dilated but the tension remained normal. In nine days' time the lens began to swell from acute cataract formation and I was compelled to advise its removal.

Operation on April 16, 1921: Sixteen days after the first

operation the cataract was successfully extracted. The anterior capsule remained adherent to the posterior surface of the cornea at its upper part and so the capsule was retained within the globe being dislocated upward, however, so that there was a perfectly clear space below it in the axis of vision. With suitable lenses the vision was $\frac{2}{3}$. The field of vision was normal; and fundus likewise appeared normal. It looked like a most happy result after all, but on May 27th, which was six weeks after the cataract operation, glaucoma suddenly returned and the tension rose inside of twenty-four hours from 22mm to 46mm mercury. I advised the iridectomy operation at once.

Operation, May 28th: Iridectomy of both arms of the coloboma was successfully performed under local anaesthesia employed subconjunctivally and the tension was by it reduced to below normal again.

The right eye was inspected at each dressing for I was always fearful of glaucoma appearing in it. The family history as to glaucoma was bad and the disease had appeared spontaneously in her left eye and without known cause.

On the seventh day after the last operation (viz. on June 4th) I noticed slight ovality of the right pupil. The eyeball was perfectly pale, the vision was normal, but the pupil was contracted and as stated was of oval contour. Examination by focal illumination aided by loupe revealed well established ring synechia. The tension by the finger test seemed soft, not over 18mm (estimated). I suspected sympathetic ophthalmia at once and called for a consultation with Dr. Clarence King.

Dr. King agreed that a quiet iritis was established in her second eye. We desired to use a mydriatic but how could we safely do so with the history of glaucoma so recently in the case? Finally Dr. King and I agreed to use euphthalmine or homatropine cautiously.

Seven per cent. solution euphthalmine dropped in the eye dilated the pupil slightly, demonstrating a crenated pupil margin. Two per cent. solution of homatropine drops dilated it still more, demonstrating at first a daisy-shaped pupil, finally a kidney-shaped pupil, and thus one by one all the synechiæ were separated within twenty-four hours excepting one strong one below which resisted.

Examination of the fundus was now possible and I discovered a positive plastic optic neuritis and peri-neural retinitis. One exudation was very striking near the disk margin at about "one o'clock." The macula lutea was distinctly oedematous, fine precipitates were observed in the aqueous chamber. The vitreous presented fine opacities in

great numbers. The tension with McLean's tonometer was 19mm mercury.

Dr. King thought toxemia or chronic septicemia was a possible cause and that perhaps the trouble was more in the nature of a toxemic neuro-retinitis and iritis.

Dr. J. E. Greiwe, a prominent internist, was summoned to examine and report on the patient's general physical state. Dr. Greiwe made a thorough physical examination including blood count and urinalysis, reporting his findings in writing. He conducted a Wassermann test and found it to be negative. He discovered abscesses at the apices of six of her teeth by X-ray examination and finally returned a diagnosis of secondary anemia probably due to chronic bacteremia—recommending intravenous injections of the citrate of iron (0.10 in 1cc hypule form).

At this juncture Dr. Harold Gifford of Omaha was called in consultation.

Dr. Gifford made a thorough examination of the patient's eyes and finally diagnosed sympathetic ophthalmia. He agreed that the citrate of iron should be given and repeated every second day until the anemia was overcome. He strongly urged that the patient, whose body weight was less than one hundred and twenty pounds, be given one hundred and twenty grains salicylate of sodium every day without ceasing for weeks and months if need be or until convalescence was established. He advised atophan as a good substitute to be given *per os* in case the sodium salicylate disturbed the digestion.

He considered the advisability of removing the first eye. It possessed $\frac{2}{3}0\%$ vision at that time and a normal peripheral field of vision by the candle test, and so he advised against enucleation, stating that if blindness of her second eye supervened the first eye might be the better of the two.

It would make tiresome reading to publish all the notes from this on. Suffice it to say we secured written instructions from Dr. Gifford and gave the patient the dosage he advised.

The patient took sixty grains of sodium salicylate every morning *per rectum* and thirty grains of atophan *per os* every day after the noon meal; in addition to this she took an extra dose of sixty grains of salicylate of sodium *per rectum* at bedtime every third day. This was the program she followed for three months, *ninety days without a break*, and after that the same doses were taken every second day for thirty more days and then twice a week for another thirty days.

For two and one half months she was given every second day the 0.10 citrate iron intravenously by Dr. Greiwe.

Ten days after Drs. Gifford and Greiwe's treatments were

instituted there were signs of a clearing-up process in her second eye. The fundus looked brighter. Her vision which had fallen to $\frac{1}{10}$ became $\frac{2}{5}$.

On July 21st, or six weeks after consultation with Dr. Gifford, a remarkable phenomenon occurred. The firm synechia melted away and disappeared leaving the pupil perfectly round and mobile throughout. This phenomenon took place without the aid of a mydriatic. Moreover *every vestige of ring deposit of pigment and lymph on the anterior capsule of the lens disappeared. The precipitates in the aqueous and the opacities in the vitreous humors all disappeared. The fundus cleared up as regards all the exudations and cloudy swellings.* The tension became normal (24mm mercury). The vision became normal, $\frac{2}{5}$ + and Ja. I.

Within two months after the treatment of Gifford and Greiwe was instituted the second eye seemed to be cured.

On November 16, 1921, seven and one half months after the disease began, all treatment was withdrawn and the patient pronounced cured as regards her second eye.

I had repeatedly suggested the employment of salvarsan in this case to combat the anemia but it was refused by her husband who, knowing what the remedy was used for, would not allow it to be employed.

The six offending teeth were drawn in three seances of two weeks' interval for it was feared that to draw these all at once might have a tendency to liberate septic poisons in the blood in damaging quantities.

The *first eye* has a normal field of vision by candle test but no quantitative vision is present on account of *occlusio pupillæ*. The tension is normal, eyeball is pale like the second eye, and the cornea is clear, but the iris is bombé. The space of the coloboma is filled with gray organized exudate completely blocking the pupil.

It is too soon to state that no further trouble will develop in the first eye; most likely it will become glaucomic, but the second eye is apparently entirely cured and should remain so.

If the first eye should develop glaucoma again we all agree that the only operation to consider for it will be enucleation.

COMMENT: This is a remarkable case presenting all the clinical manifestations of genuine sympathetic ophthalmia. The first eye was not removed and hence must have discharged large quantities of protein poisons in the blood, all of which were overpowered by the persistent use of large doses of salicylate of sodium and its substitute, atophan, aided no doubt by the upbuilding of the red blood cells by the action of citrate

of iron thrown directly into the blood stream by intravenous injections. Her anemia was overcome. She gained in weight and lost the excessive pallor of her skin. The removal of the teeth that presented apical abscesses may have removed the source of provocative or contributory toxemia. In all events the cure is complete.

THE USE OF THE GULLSTRAND SLIT LAMP.¹

BY DR. HARRY S. GRADLE, CHICAGO, ILL.

(With one illustration on Text-Plate XIV. and seven in the text.)

THE value of the slit lamp depends upon one of the simplest principles known to physics, so simple that it was overlooked until Gullstrand adapted it in the instrument that has added so much to our knowledge of the human eye. The principle is that of simultaneous contrast. A particle of dust floating in the air of a diffusely illuminated room cannot be perceived because of the lack of contrast. But allow a beam of sunshine or any concentrated light of sufficient intensity to pass through the room and the particle of dust becomes visible immediately and clearly, due to simultaneous contrast. The same principle holds true in examination of the tissues of the living eye with varying degrees of magnification. A diffuse illumination does not allow the particle of tissue in question to stand out in contrast to neighboring particles. But the concentration of a beam of intensive light upon an area, at the cost of illumination of adjacent areas, reveals details of structure hitherto unknown. Such is the power of focal illumination and simultaneous contrast.

Microscopy of the living eye is accomplished by means of a combination: a microscope, and a focal illuminant.

The binocular microscope is not of recent origin, although many improvements have been added to increase the efficiency. In 1899, Czapski developed the microscope that to-day bears his name. It consists of two convergent tubes with a double objective, and two oculars. The rays of light from a point

¹ Read before the American Acad. Ophth. Oto-Larygn., Philadelphia, Pa., October 20, 1921.

pass through the converging objectives and fall upon a pair of Porro prisms, which reverse the image and bring it into an upright position and at the same time allow the tubes to be swung apart or together to coincide with the interpupillary distance of the observer.

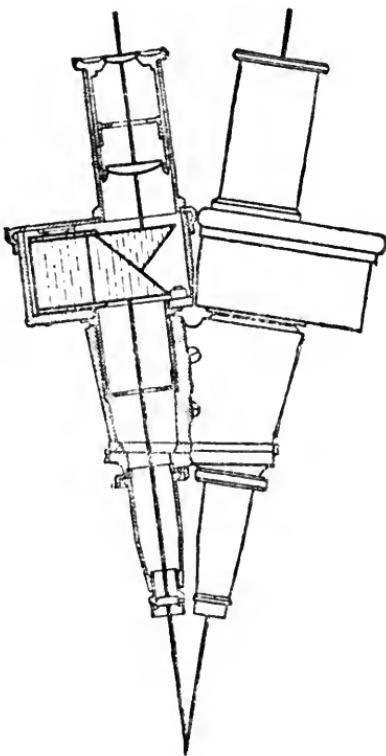


FIG. 2.

Schematic cross section of binocular corneal microscope.

The rays are then continued through the well-known Huygens oculars, which collect the main rays diverging from the objectives, which enlarge the image received from the objectives and bring the rays to a parallel or converging course, in order that they may be properly focused upon the retina of the observer. By changing the objectives as well as the oculars, magnifications ranging from twenty to one hundred and three diameters can be obtained.

For examination of the deeper recesses of the eye, a modification of the corneal microscope, known as the "Bitumi," has been devised. This consists of a single objective of somewhat greater length, a single microscope tube, a set of half silvered glass plates, which function essentially the same as the glass prisms in the Abbe stereoscopic ocular, and a pair of parallel oculars. The interpupillary distance of the observer is accounted for by a simple device, which separates the parallel ocular tubes the required distance.

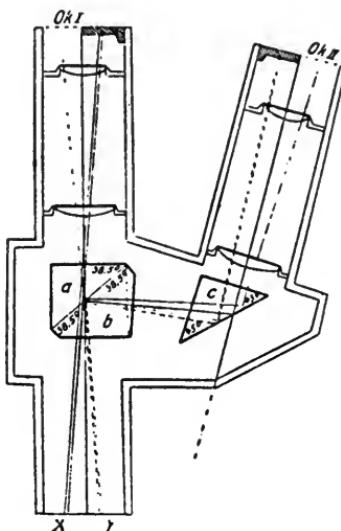


FIG. 3.

Schematic course of rays through Abbe stereoscopic ocular.

The Bitumi presents the following advantages over the binocular corneal microscope: (1) greater magnification, even beyond the limits imposed by the involuntary movements of the eye under observation, and (2) penetration into the deeper structures, that are without the pale of the Czapski, because of the separation of the entrance pupils of the converging tubes. On the other hand, the Bitumi is somewhat more difficult to handle (the image is reversed) and there is a considerable loss of light.

The illuminant is a 25-volt Niteral lamp, operating upon a 110-volt current with an interposed resistance. The lamp

itself has a tightly wound spiral filament within a rather small gas-filled chamber, and presents as nearly as possible a vertical line of light. The divergent rays are rendered parallel by a single planoconvex lens, and are again converged by a

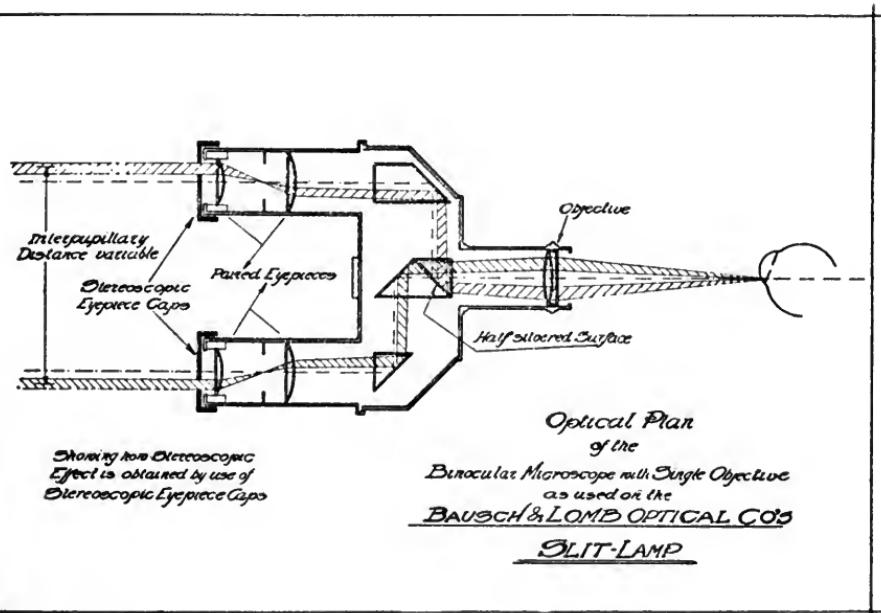


Fig. 4.

planoconvex lens upon a slit of variable dimensions. The spherical aberration is to a great extent eliminated by having the spherical surfaces of the lenses facing each other. Thus an image of the luminous filament is formed in the slit.

The almost parallel rays of this image are then brought to a linear point by the condensing lens at the end of the lamp arm. Lateral diffusion is eliminated by the tube interposed between the slit and the condensing lens, which tube also serves to carry various filters that are used in special examinations. For penetration into the deeper structures of the eye, a metallic mirror is set in an upright at the extreme end of the lamp arm, beyond the condensing lens. When it is necessary to make the angle of convergence of the axis of illumination and the axis of observation as small as possible, the lamp arm is put at right angles to the axis of observation, and the

illuminating beam is turned at right angles by the mirror. This eliminates mechanical difficulties.

Exact centration of the lamp is essential. The lamp socket must be rotated until the filament is exactly vertical and then locked in place by the fixation screw. The slit must also be vertical and so placed that the image of the slit falls in the

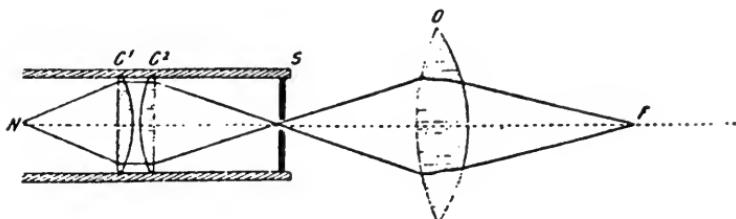


FIG. 5.

Schematic course of rays in the illuminating apparatus.

exact center of the condensing lens. Lateral movement of the slit is provided for by a helical arrangement. In the beginning, it is preferable to open the slit as wide as possible, but for varying conditions the width may be reduced to advantage.

The patient must be seated comfortably with the chin resting firmly upon the chin rest, and the head braced against the forehead rest. Strained and unnatural positions should be avoided. The patient should be instructed where to look, and in many cases the small fixation lamp attached to the instrument is of great value, particularly in examination of the fundus. To obtain the first rough position of the microscope, the eye may be sufficiently illuminated by withdrawing the lamp until the broadened slit covers a fair share of the cornea. The microscope should then be moved by means of the double adjustable base until the primary rough focus is obtained. The lamp is then moved forward until the image of the slit appears upon the cornea, in approximately the focal size. The final fine adjustment is made with the rack and pinion that operates the condensing lens upon the lamp arm. The observer, who by this time has adjusted the microscope to his own interpupillary distance, focuses the microscope upon the tissue under examination. If the left eye of the patient is being observed, the lamp is upon the observer's right, and

his right hand is occupied with the rack and pinion adjustment of the condensing lens and with the lateral motion of the base, while his left hand manipulates the fine adjustment of the microscope and keeps it trained upon the area in question. The reverse position obtains for the other eye.

Four types of illumination come into consideration. The first is the basic principle of the instrument, *direct focal illumination*, and has already been discussed. The second is illumination by *indirect focal light*. During the observation of any specific area by direct focal illumination, it will be noticed that contiguous areas can be seen and in a more plastic form, owing to their illumination by reflected and diffused light from the more brightly illuminated zone. This method is particularly of value for the study of delicate opacities. The third is *dark field illumination*, and applies of course only to the transparent or translucent areas of the eye. The focal point of light is directed upon an area behind the structure to be observed, which then stands out in the well-known dark field form. The examination of structures with different indices of refraction, as blood vessels or nerves in the cornea, is facilitated by this method. The fourth, and but little used, type is observation in an *oscillating light field*, where the oscillations are produced by manipulation of the lamp arm.

For examination of the background of the living eye, a slightly different technic is employed. The lamp arm is placed at right angles to the axis of the Bitumi, and the beam of light is bent at slightly more than ninety degrees by the metallic mirror at the end of the lamp arm. The illuminating bundle thus forms a sharply convergent bundle, with the axis of observation and the mirror in juxtaposition with the tip of the microscopic objective.

In order to bring the image of the background forward to within the range of the microscope, it is necessary to use a contact glass of the type designed by Fick. Such a glass fits directly over the cornea, and has a posterior radius of curvature of 8mm and a diameter of 12mm. The anterior surface of the glass is ground flatter than the posterior, has a radius of 10mm and an equivalent value of +5D. This makes the refraction of the glass equal to -59.5D., and brings the image of the retina some 16.7mm behind the posterior surface of the

cornea, or about in the middle of the anterior third of the vitreous. This image is slightly smaller than the true retina (0.96).

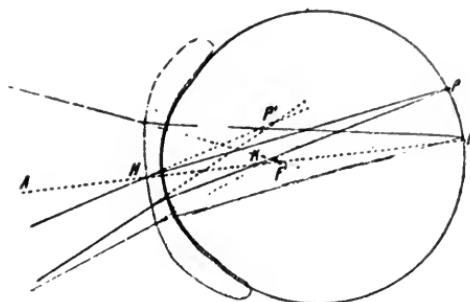


FIG. 6.

Schematic course of rays through contact glass, showing how the retina is brought forward.

For such observation, it is necessary to have the eye in good mydriasis and well anaesthetized. The patient's head should be tilted forward, and the lids opened with the fingers of one hand. The contact glass, previously filled with warm normal salt solution, is then applied directly over the cornea, which must be tilted slightly downward. Immediately upon application of the glass, the patient must look directly forward and the lids be allowed to close spontaneously. (It is almost unnecessary to add that fingers must not touch the observation surface of the glass, because of resultant diffusion by adherent grease.) If a bubble lies between the glass and the cornea, the procedure must be repeated, or else the upper edge of the glass can be lifted away from the sclera with an iris spatula, and a thin stream of salt solution allowed to fill in from a small pipette. The flattened portion of the glass should be directly over the pupillary area of the cornea, and should there be a tendency to drop, the glass can be held in place by light pressure on the lower lid. Removal of the glass is accomplished by lifting the upper edge with the spatula, whereupon the upper lid in closing forces the glass out. Care must be taken to avoid dropping or scratching the glass.

After the contact glass has been applied, the patient is seated before the Bitumi as previously described, and the lamp arm and metallic mirror adjusted so that the focal slit falls first upon the edge of the iris, and then 14 or more mm behind it. The fine adjustment must be made with the entire apparatus rather than with the condensing lens. The Bitumi is then moved into place, and the brilliantly illuminated fundus comes into view. The same adjustment holds for the examination of the vitreous, merely changing the focus of the different instruments.

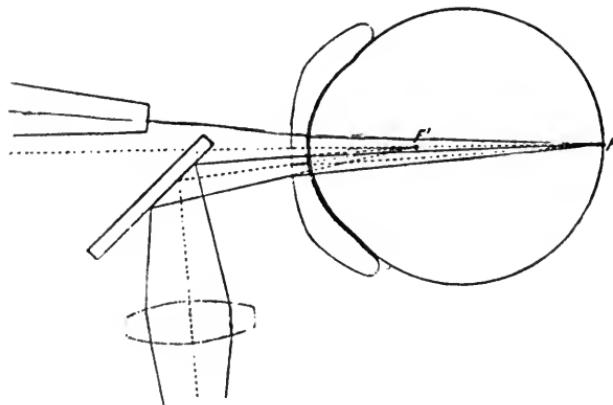


FIG. 7.

Schematic course of rays in microscopy of the human fundus.

The angle of the anterior chamber may be examined in the same manner, although the use of a miotic is necessary, and the patient's head must be turned about 45 degrees on the chin rest. A different type of contact glass is used, with a concave anterior surface ground upon a heavily convexed surface. The illumination enters through a very sharp angle, while the observation axis is nearly parallel to the surface of the iris. Needless to add, it is much simpler to examine the chamber angle from the temporal than from the nasal aspect.

From the foregoing rough description, it can be seen that many new phases of examination of the living eye are made possible by the use of the slit lamp of Gullstrand. For daily clinical use, the binocular microscope and the first three types

of illumination mentioned afford a much more intimate knowledge of pathologic processes of the anterior eye than was ever deemed possible, and practice renders such examinations fairly rapid. The use of higher magnifications, and of the apparatus

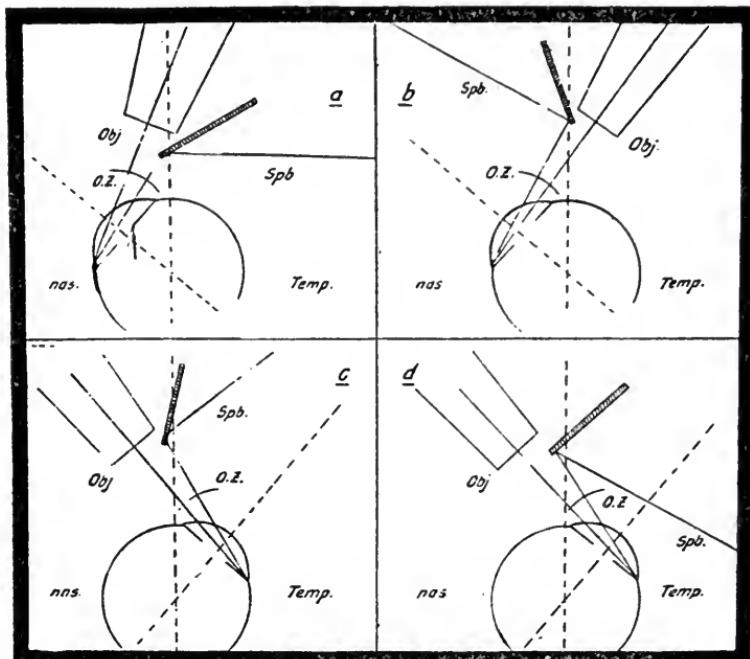


FIG. 8.

Schematic course of rays for chamber angle microscopy.

for examination of the chamber angle and of the background, is somewhat more laborious, but in many obscure cases the time thus spent is well recompensed by the more intimate knowledge gained.

Many of the schematic illustrations used are taken from Koeppel, *Die biophysikalischen Untersuchungsmethoden der normalen und pathologischen Histologie des lebenden Auges*.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. H. DICKINSON, LONDON.

A meeting of the Section was held on Friday, January 13, 1922, under the presidency of Dr. JAMES TAYLOR.

Sir John Herbert Parsons's Knighthood.

The PRESIDENT felicitated Sir John Herbert Parsons on the honor of Knighthood, which the King had recently conferred on him, and in the name of the Section expressed the hope that Sir John would live long to enjoy it.

Sir JOHN PARSONS, in returning thanks, said the honor was a recognition of his having served on a number of Government Committees, on which, however, he only served as an ophthalmologist, therefore it was an honor to ophthalmology, and he was the fortunate peg on which it was hung.

Cases.

Mr. DOYNE showed a case with a **congenital deformity of the conjunctiva**, associated with deformities of tongue and thumb in the same patient.

Mr. REA showed a case of **filamentary keratitis**, which lasted three years and had been very resistant to treatment. When bullae were removed, the patient came with a fresh crop in three weeks. Tension was normal, and there was no suggestion of glaucoma. The woman had suffered from arthritis for many years.

Mr. HUMPHREY NEAME showed a case with branching remnants of persistent hyaloid vessels. He thought it likely

that these processes arose from one common trunk. Vision in the right eye, with correction, was $\frac{6}{36}$, in the left $\frac{1}{2}$. There was also a thickening of the walls of some of the arteries in the right fundus; the strands had no connection with the lens capsule.

Miss MANN exhibited slides and drawings of embryonic eyes showing the earliest formation of a definite hyaloid artery. Until just before five weeks, she said, the globe was filled with mesoderm in the meshes of which there were blood vessels but definite branching arteries could not be traced much below five weeks. There were usually five branches of the vessel, and they broke up again into blood spaces, which quite surrounded the lens. A 3 months' embryo showed a differentiation of retina, with optic nerve. From the center of it came a definite hyaloid artery with thick walls. That broke up into five branches. She next showed an equatorial section 6mm in front of the disk; it showed a division into three main branches. In the next section, 1mm in front of the last, there was again a division into five. That went on to the sixth month, after which it began to disappear again.

Mr. M. S. MAYOU referred to injected specimens of hyaloid artery in embryo which he did some years ago. At the 4th month it could be seen that the hyaloid did not break up at the back of the lens, as so many text-books depicted, but far back in the vitreous. The posterior vascular capsule was formed by a cone of vessels passing up to the back of the lens. In some cases one branch was found persisting and anastomosing with the ciliary body. Sometimes there were masses of fibrous tissue at the back of the lens, which were supposed to be remnants of the hyaloid artery.

Mr. LESLIE PATON suggested that Mr. NEAME's case might be one of proliferating retinitis.

Mr. NEAME replied that though Mr. Paton's suggestion was a likely one, the five branches seemed to come so locally from the back that this seemed to negative that idea.

Mr. M. S. MAYOU exhibited a baby with **acute necrosis in the upper jaw**. This was his third case of the kind, all under one year old. One had successive portions of the jaw removed until none remained; it was a spreading necrosis. It was an acute process in all the cases, and he believed the mouth could

be excluded as a channel of infection in the present case; moreover the disease occurred before teething, and before sinuses were present in the bone.

Mr. LESLIE PATON mentioned a case of his own of the same character, a healthy breast-fed child nearly four months old. When he first saw the child there was a large swelling under the left eye, and the eye was proptosed forwards and outwards to the extent of an inch. He evacuated about an ounce of pus from behind the eye. Bare bone was evident to the probe, but there had not been time for necrosis to have taken place. The condition seemed to belong to the same category as acute osteomyelitis in infants.

Mr. STACK enquired whether syphilis and tubercle could be excluded.

Mr. PATON replied that those diseases could be excluded in his own case; the only organism found in it was staphylococcus.

Mr. MAYOU, in his reply, said both parents in one of the cases proved negative to Wassermann, in another the doctor was so sure there was no suspicion of syphilis that the test was not applied. The cases were, he thought, too acute for tubercle to be the cause; one had a temperature of 103°, and a pulse of 130.

Mr. LANG showed an operating lamp; it could be attached to the ordinary bracket and carry a $\frac{1}{2}$ -watt lamp, with the necessary resistance. It enabled fluorescine staining, such as in corneal ulcer, to be well seen.

Trephine Operations for Glaucoma. Experience Gained in 140 Cases.

Mr. MALCOLM L. HEPBURN read a paper entitled **Experience Gained from 140 Trephine Operations for Glaucoma.**

He regarded glaucoma as such a serious condition, especially the chronic type, with its variety of symptoms and signs, that the question of operative interference merited all possible discussion. Recently contributions had appeared favoring iris-inclusion and silk-inclusion operations, somewhat to the detriment of the iris-free operations. The reporting of late infections had deterred some surgeons from confidently recom-

mending trephining, and had led some to give it up. In perforating wounds of the eye, and after cataract extractions, surgeons tried to avoid permanent inclusion of iris in the wound because of the danger alleged to be associated with such inclusion, and he could not see the justification of it in operations for glaucoma, unless other methods had failed. The danger of leaving an opening in the eye separated from the external air by only a thin layer of conjunctiva was admitted, but it applied to all filtering scars, and the only question was as to which was the least dangerous.

In the 140 trephine operations he had performed in the last nine years, 27 were in private patients; and if the combined hospital experience of his colleagues could be studied, he thought there would be overwhelming evidence in favor of the trephine operation. At Moorfields, at least, late infection was very rare, and he believed its occurrence in a general way had been much exaggerated. He had not been without complications in his cases.

With regard to the technique he followed, the importance of an efficient conjunctival flap was very great in striving to avoid late infection; he made the flap as thick as possible, and he did his best to prevent tearing or button-holing of the conjunctiva, stripping the conjunctiva off the globe in its whole thickness down to the sclera from the beginning, and continued cutting with the scissors, the points of which were kept directed towards the globe. Toothed forceps he used only for the initial fixation, subsequently those employed were very fine toothless ones. On reaching the limbus he used the secondary cataract knife, keeping it directed towards the globe and pressing slightly. He never found that he got too far forwards, as he always found himself farther back at the end of the operation than he expected to be. Before commencing rotatory movements he drew the flap upwards and backwards so that it was parallel to the trephine, so avoiding button-holing. While rotating the trephine, he directed the handle forwards so as to cut through the anterior part of the scleral disk before the posterior to ensure the formation of a hinge posteriorly when the section was complete; then the disk could be removed later without fear of injuring the conjunctival flap. Having once got the trephine to bite, he did not remove it until

the section was finished, so that the full force of the aqueous discharge would push the knuckle of iris well out of the wound. The guide to the penetration of the sclera was the coming up of the pupil towards the hole. When the iris presented, it must be dealt with at once; the disk could be left to take care of itself. He grasped the iris with very fine straight forceps, at the same time pulling downwards and forwards, so as to detach it from its root. Lastly, he cut off the disk, which could be done easily without endangering the conjunctiva. Usually he inserted one or two stitches in the conjunctival flap; perhaps there should be more.

Proceeding to the consideration of complications, Mr. Hepburn said that if a hole was seen in the flap, a new point of application of the trephine must be selected. Three or four times loss of the disk had happened to him; it might be drawn into the anterior chamber, it might be left in the trephine, or it might be washed away when the aqueous was discharged. Sometimes the iris was so dilated at the time of operation, that the force of the aqueous discharge caused a total prolapse to the pupillary border; in this case all the prolapsed part must be cut off and a complete iridectomy performed. On occasion a complete iridectomy occurred from a too free division. If a complete iridectomy was intentionally done, the iris must be pulled well out of the wound. Apart from cases of buphthalmos—in which the accident was not uncommon—he had had vitreous loss only three or four times. Whether it influenced the subsequent draining capacity depended somewhat on whether the vitreous was solid or liquid. In two of his cases there was good drainage and no affection of vision afterwards; in one case the vision had remained at §.

With regard to delay in the re-formation of the anterior chamber this had occurred in about six of his series of cases. He now allowed these patients to be out of bed at the usual time after the operation, when he usually found that the anterior chamber formed immediately. When this formation was delayed unduly, he was anxious lest there might be adhesion of the iris to the trephine hole; for this reason he always used atropin as a routine treatment. In two or three of his cases the lens had come forward, but only in one case was he able to assure himself that there were no opacities previously. He

was not aware of detachment of choroid having happened often in his cases, but it might occur without being recognized. He had not encountered serious complications from this cause, though it might account for failure in the re-formation of the anterior chamber.

What cases were to be included in the term "late infection"? As the permanent opening in the eyeball was the weak point in the operation, the entry or organisms through this channel must be established to justify the use of the phrase; he thought inflammatory reaction must be associated with rupture of the conjunctival flap. Inflammations occurring many years after operation when there was a thick and firmly attached flap could not be included as late infections. And he did not see why every type of inflammation occurring in an eye after trephining should be directly ascribed to the operation.

A general review of his cases showed that by far the best results ensued in cases which he secured early, and especially if he had been able to do the operation at a time when the tension of the eye was normal. In acute glaucoma he only trephined if he had been able to reduce the tension before operating. If he could not reduce it, his practice now was to perform iridectomy. He had seen two eyes in the same patient in which one had been trephined in an early stage, but in which operation on the other eye had to be postponed, and the unoperated eye steadily went downhill with the same symptoms; but after operation these symptoms were cut short and controlled. That his private cases had been more successful than the hospital ones he attributed to the fact that private patients were more observant and anxious about initial symptoms, and early sought advice. His 13 failures in the 140 had been in cases whose tension at the time of operation was raised, when there was a long history of the trouble, and in which the field had been contracted in a general way, almost to the fixation-point. As failures he reckoned those cases in which sight was restricted to finger-counting, with much contraction of the visual field, and where no improvement followed the operation. Many cases appeared to have worse vision immediately after the operation but it improved later. He seldom had good results in acute or in secondary glaucoma; both these kinds showed too much congestion round the limbus

and this encouraged healing of the trephine hole. Moreover, in acute glaucoma the conjunctiva was often very friable. He had had two cases of cyclitis; both recovered. He had had no case of sympathetic trouble following trephining.

As a result of his experience, he had formed the opinion that the operation of trephining, performed with every consideration for the conjunctival flap, was the ideal one for chronic glaucoma, especially for the type generally met with in young adults.

Mr. R. R. CRUISE said all surgeons naturally preferred the type of operation which, in their hands, had been successful. He had now ceased to do trephining for glaucoma, though at one stage in his practice he trephined all his cases of that nature. He abandoned the operation because of one or two disasters, and since he had changed his operation those had not happened. In two there was an escape of vitreous; not, he thought, through any fault in technique. At the operation on one of them a colleague was present and praised the operation, foretelling a good result. He called in colleagues in consultation. The eye remained quiet, but vitreous continued to come out. He cautiously sealed up the hole, and the tension rose to *plus* 3 or 4, and the lens was drawn up. It was the patient's only eye, and he went blind. In two cases there was infection afterwards, causing conjunctivitis; these patients were left with vitreous opacities. He had also had, when doing trephining, a good deal of subconjunctival thickening round the trephine hole margins. For ten years he had been doing a modified flap sclerotomy, doing rather more than Herbert did, *i.e.*, completing the two sides of the flap well forward into the cornea, and beyond the rim of resistance felt when cutting through. It was very important not to suture the conjunctiva. One of the features of trephining which made him more dubious about it was the transparent pedicle which remained, enabling one to look into the depths of the eye.

Mr. M. S. MAYOU agreed as to the transparent bubble which was left after trephining, and it was a spot very difficult to cover and protect. A further objection was that the cornea had to be split in order to get the trephine on properly. During the last three months the speaker had been carrying out the

new operation of Holt, who claimed it did not leave a transparent bubble and that was true in the cases in which Mr. Mayou had so far done it. He described Professor Harden's method of ascertaining detachment of the choroid. The examination, done as early as the second or third day, was carried out by means of the contact-illuminator. This was put on the globe 5 or 6mm behind the sclera, and if there was a detachment of choroid, the whole area of sclera right to the cornea would be illuminated; but if the choroid was in its place there would be illuminated only an area around the point of contact.

Mr. LANG thought the danger arising from the hole in the flap had been much exaggerated. The amount of drainage was directly proportional to the diameter of the trephine hole. The operation he did for glaucoma was a modified Lagrange, turning back a piece of conjunctival flap and taking away a part of the cornea.

Mr. HEPBURN, in the course of his reply, considered that Mr. Cruise had had bad luck in his cases which caused him to adopt a different procedure. He, the speaker, did not find transparent blebs were common, and when they did occur they got thicker with the passage of time. He had never found that splitting of the cornea made any difference. The Lagrange operation was, in his opinion, merely a glorified trephine operation. Though patients who had a hole in the conjunctiva might survive trouble or escape it, it was not wise to design a procedure on that assumption.

Epibulbar Sarcoma, with Penetration of the Globe.

Mr. HUMPHREY NEAME read a paper on this subject, illustrated by a number of micro-photographs, projected by the epidiascope. In May, 1919, the patient noticed a swelling under the upper lid of the left eye. There was a history of syphilis, of recent ulceration of the palate, and deformity of the nasal bones, and the Wassermann reaction was positive. For some time the swelling was regarded as a gummatous infiltration but as it did not react to anti-syphilitic treatment, and the eye was practically blind, Sir John Herbert Parsons, under whose care the patient was, decided to enucleate the eye. Patho-

logical examination revealed an extensive epibulbar growth, with extension within the globe. The growth surrounded the cornea and, as a thin sheet, spread around the eye to the posterior pole. The iris, ciliary body, and choroid were completely infiltrated with the same type of growth. It was a round-celled sarcoma, with slightly alveolar formation. Within three months of the enucleation there was a recurrence within the orbit and Sir John Parsons carried out exenteration of the orbit. There was a mass of round-celled recurrent growth not definitely delimited from the orbital tissues. The stump of the optic nerve, in transverse section at the posterior limit, was free from growth cells. An extension of extra-bulbar sarcoma within the globe was an extremely rare condition. Less rarely, sarcoma started in the choroid, and extended out through the coats of the eye, usually by the perivascular lymphatics of the various perforating vessels. Mr. Neame thought there was more evidence that this growth was of extra-bulbar origin than that it was at first intra-bulbar. The reasons he adduced were:

(1) The earliest symptoms were referred to the epibulbar region above the cornea. (2) The vision in the eye, within two months of the commencement of symptoms, was $\frac{1}{2}$ with the appropriate glass; no visual failure in it was noted until 7 months after the onset. An extensive choroidal growth usually affected the vision. (3) The growth was much more massive at the point first noticed than elsewhere. (4) The gross appearance of the choroidal growth resembled a secondary or metastatic growth more than a primary growth there. (5) The alternative, flat sarcoma of choroid, was usually densely pigmented, whereas this was a non-pigmented growth. (6) Flat sarcoma was almost always relatively vascular, whereas throughout the present growth there were many delicate capillaries. (7) Flat sarcoma often invaded the deeper layers of the sclerotic, but this growth had only slightly done so, but had definitely invaded the superficial layers of this structure in various parts. He concluded with some extracts from literature bearing on the subject.

SIR JOHN PARSONS referred to the close mimicry of this condition, in its earlier stages, of gummatous infiltration of the conjunctiva and sclera, especially when, as in this case, the

reaction to Wassermann was positive. Only slowly, after a long course of anti-syphilitic treatment had been given, was it realized to be a new growth. Concerning epibulbar growths in general, on reading cases of the kind he could not quite convince himself that there had not been some small lesion in the eye which had subsequently extended outwards. Even in Mr. Neame's case there was that possibility, though the author of the paper had adduced much evidence favoring the opposite possibility.

Mr. MAYOU threw out the suggestion that a flat sarcoma might have existed in the anterior part of the globe and then perforated, good vision nevertheless persisting. In flat sarcoma the retina remained attached for a long time. One of his patients had detachment in the anterior part of the globe, and vision was still $\frac{1}{8}$ when the eye was removed. The growth had infiltrated the canals along the vortex of veins and lymphatics. The patient died two years later of recurrence. He suggested that this case should be submitted to a Pathological Committee, to place it on a sure basis. This was agreed to.

Mr. E. TREACHER COLLINS pointed out that there could be no doubt as to the direction of spread in the case of epithelioma as that type of growth never started in the eye, however much doubt might be thrown on the manner of spread of epibulbar sarcoma. He referred to a paper he read some years ago before the Ophthalmological Society on epibulbar epithelioma. He showed then illustrations of epithelioma spreading along the vessels at the limbus into the canal of Schlemm, and he had read of other cases which behaved similarly. A further point favoring Mr. Neame's view was the way the growth spread on the outer surface of the sclerotic. If a piece for diagnosis had been removed in this case earlier, removal of the eyeball might have been obviated, and the case rendered more hopeful. He referred to a case of his own in which he cut off the top of the growth and sent the patient to be further treated at the Radium Institute, and after two or three applications of radium, the growth entirely disappeared and he knew of no recurrence of it.

Mr. J. H. FISHER agreed that a piece should have been removed earlier, and referred to a case of his own of similar nature in which subsequent application of the actual cautery prevented any recurrence.

Mr. LESLIE PATON also alluded to an interesting case, in which the application of radium for 24 hours after the operation kept the man free for a long time, and a swelling of the soft palate, probably of the same nature, which developed was similarly treated with radium and that also disappeared.

The ordinary meeting of the Section was held on Friday, February 10, 1922, the President of the Section, Dr. JAMES TAYLOR, occupying the Chair.

Symmetrical Macular Disease.

Mr. FRANK JULER showed a youth with **symmetrical disease of the macula.** The changes were quite superficial in the retina, not in the choroid. The youth was sent up by his employers in a rubber factory, to find out whether anything could be done for him, and also to ascertain whether the condition had any connection with his occupation. He had been at the factory three years, his eye condition having appeared just before he started there. It was ascertained that the lad's work did not bring him into contact with the fumes given off in the manufacture, and Mr. Juler did not think there was any relationship of the condition to the employment. From the appearances it might possibly be a case of familial disease, such as Dr. Batten pointed out in association with cerebral degeneration; but this lad was quite bright and alert, and seemed to have done well at school. An elder brother of the patient was affected somewhat similarly, and he had been seen by Mr. Burdon-Cooper, of Bath, in 1915, when he was 21 years of age. Vision was $\frac{1}{6}$ in each eye, and there was central choroiditis. He was given some mercurial ointment for inunction, and he was seen again in 1919, when the vision was much worse, and Wassermann reaction had been positive on two tests. Some members of other branches of the present patient's family seemed to be affected by a similar condition. Another possibility was that this condition was inflammatory; but the boy appeared to be healthy, his Wassermann was negative, and it had remained so even under a provocative dose of Novarseno-bouillon. Von Pirquet was negative; the only feature out of the ordinary which was discernible was the presence of some septic crypts in the tonsils.

Plastic Operation for Lid Deformity.

Mr. OLIVER showed a patient on whom a plastic series was being done with the object of making a passable eyelid. The subject was a man who was wounded in 1916. When he came to the exhibitor two months ago he had had a number of operations. When he saw the man, the condition was that the whole of the skin of the upper lid had disappeared, and the lid was pulled up and was adherent to the upper orbital margin. The cornea was exposed, and there had been severe corneal ulcerations, which had left a nebula. He first excised all the scar tissue, and he thought that in all plastic operations it was most important to replace tissue in its normal situation. The tissues of the lid which were left could then be replaced, with some of the lashes. That left a large bare surface to be covered up, and it was covered by a temporal flap, in which flap it was very important to include the superficial temporal artery. All that now remained was to remove the whole pedicle. The operation was Major Gillies', and he had found it a most useful one.

Cholesterin Crystals in the Cornea.

Mr. R. AFFLECK GREEVES showed, as a curiosity, a patient with cholesterin crystals in the cornea; he had not seen or heard of such a case before. Cholesterin was common in other parts of the eye; in the retina and vitreous, and sometimes in the anterior chamber and lens. This patient had had extensive chronic ulceration of the cornea, with much photophobia and pain. There was found to be chronic disease of the antrum. After that had been treated, the ulceration cleared up a good deal and healed over. There were still attacks of pain and photophobia, but without ulceration. The patch of cholesterin had gradually increased in size for a year, and now there were also two smaller patches. The cholesterin probably resulted from the splitting up of the protein molecule, and, apparently, it could arise from the degeneration of blood, or from degeneration of tissues, though the usual form of degeneration was hyaline, with calcareous deposits.

Mr. M. S. MAYOU referred to one case he had seen of cholesterin in the cornea, and that had long-standing interstitial

keratitis. There were a number of vessels going up towards the patch, and he thought there had been some hemorrhage from these vessels into the corneal substance, which had given rise to the cholesterin. These deposits were more frequently associated with hemorrhage than with any kind of degeneration.

The PRESIDENT thought there must be some associated cause not yet determined, otherwise it must occur much more frequently.

Mr. GREEVES pointed out, in reply, that with the lessening of the blood vessels the cholesterin patch was getting bigger.

On Certain Structures Associated with the Upper End of the Choroidal Fissure.

Miss I. C. MANN read a paper, supplemented by models and an epidiascopic demonstration, on the morphology of certain developmental structures associated with the upper end of the choroidal fissure. The particular structures she was concerned with were (1) a small, cone-shaped mass of cells in the center of the optic disk in the human embryo of the 10th week and later; (2) the mass of unpigmented cells found just below the optic stalk on the outside of the eye in a six weeks' human embryo. She wanted to show how these structures were produced by a more rapid growth of the inner layer of the optic cup than of the pigment layer. She had arrived at the conclusion that, from this point of view, the eyes of vertebrates could be divided into those showing an overgrowth of the inner layer, and those which did not show it. In a six weeks' human embryo the pigment layer was thicker, and the inner layer was separated from it. She demonstrated a small mass of unpigmented cells which was continuous with the pigment layer, a point to which she attached importance. A section through the eye of a two-day chick showed a greater elaboration of structures connected with closure of the choroidal fissure. There was here a definite overgrowth of the inner layer, that layer being thrown up into folds; and in the region of the fissure the unpigmented inner layer was heaped up on the inner side, forming a ridge, and was everted in the lips of the fissure where the inner layer became continuous with the pigment layer. At this stage, in the bird's eye, the upper part of

the eye, above the insertion of the stalk, was bigger than the lower part, and the bird's eye grew by extension of the lower part below the insertion of the optic stalk. It was stated that the bird had not a definite hyaloid artery, but in very early stages one could demonstrate a mesoderm containing blood corpuscles, this strand passing across the eye, similar to the hyaloid artery in mammals. Miss Mann proceeded to show a large number of excellently prepared specimens from different animals and from the human embryo. It had been found that the hyaloid artery got on it a bulbous enlargement as it was passing through a mass of cells, and it was this budding out which vascularized the mass, and their insinuation among the nerve fiber layer formed definitive branches of the arteria centralis retinae. The small mass of unpigmented cells on the outside of the embryonic eye was the remains of the portion of the inner layer which occasionally became everted in the upper part of the cleft, before it closed. If the eversion took place only at the upper end of the cleft, and no nerve fibers grew into it, as in man, the little mass after a time disappeared.

Dr. LEIGHTON DAVIES spoke of a case he had in which all the retinal vessels appeared at the periphery of the disk, just as in the rabbit's eye.

The PRESIDENT expressed the congratulations of the Section to Miss Mann for her interesting demonstration, and the beauty of the models and specimens with which she was working.

Three Cases of Choroidal Sarcoma.

Dr. HENRY J. MAY and Mr. F. A. WILLIAMSON-NOBLE contributed papers on this subject, Dr. May describing the clinical and operative details, and Mr. Williamson-Noble the pathological findings. All the three cases were seen by Dr. May within 19 days.

The first patient, a robust man of 60 years of age, complained of failing vision for near work, and discomfort with his glasses during a year. His distant vision was perfect. There was no evidence of inflammation in either eye. The tension in the right eye was a little fuller than in the left; the right pupil was slightly larger than the left, and was sluggish to light; the media were clear. In the fundus, below the outer side of the optic disk, he found a kidney-shaped swelling, meas-

uring $1\frac{1}{2}$ disks one way, one disk the other; on its border were two small retinal hemorrhages. There was evidence of a pushing forward by a solid mass behind. The man had been getting thinner in the last $4\frac{1}{2}$ months. At that time he would not consent to the enucleation operation which was urged. Seven months later he returned with an attack of acute glaucoma. The eye was then quite blind, and no view of the fundus could be obtained. Three days later the patient consented to enucleation. Mr. May found a typical mushroom-shaped growth, with a broad base, and it occupied the whole macula; the retina was detached. There was no evidence of extension of growth. On section the growth did not seem to have involved the sclerotic coat, and section of the optic nerve showed no sign of growth.

The second was in a man aged 52, very healthy looking. He had a painful red eye, but no trace of iritis. The cornea was bright and clear, and the tension plus 2. The anterior chamber was apparently obliterated, and the iris seemed to be in contact with Descemet's membrane. An opaque iridescent lens was tilted forward. On enucleating the eye he found a melanotic sarcoma the size of an average pea. As section of the optic nerve showed a suggestion of extension of growth to it, the orbit was exenterated. There were as yet no signs of recurrence.

The third patient was aged 67. He had been unable to see with the right eye for six months. In the right fundus, external to the disk, there seemed to be a large pigmented mass, with folds of retina lying over it or intermingled with it. The edge of the right optic disk was blurred and indistinct. Over four months later the man said his eye was totally blind; the pupil was dilated and inactive. In the fundus could be seen a large mass pushing the contents forward. Though 5 ft. 11 in. in height, this patient weighed only 8 st. 5 lbs. The eye was enucleated. The growth was a melanotic sarcoma, the optic nerve showed no extension of the growth to it. The patient had since had pains in the chest and abdomen, so there was reason to fear visceral involvement and a downward course. Dr. May discussed a number of general questions connected with this type of case, and Mr. Williamson-Noble followed with a demonstration of sections of the growth.

REPORT OF THE PROCEEDINGS OF THE SECTION
ON OPHTHALMOLOGY OF THE NEW YORK
ACADEMY OF MEDICINE.

BY DR. CONRAD BERENS, JR., SECRETARY.

MEETING OF DECEMBER 19, 1921. DR. L. W. CRIGLER, CHAIRMAN.

PRESENTATION OF PATIENTS. Dr. W. H. Wootton presented a case of **paralytic miosis**. The patient, female, twenty-five years, came to the Manhattan Eye, Ear, and Throat Hospital complaining of sudden loss of vision in the right eye. Vision O. D. shadows, O. S. $\frac{1}{4}$ with correction. Marked iridodonesis and miosis O. U. There was a complete retinal detachment in the right eye. The lens in each eye could be made out in the lower part of the vitreous. Pupils could not be dilated beyond 2mm with either atropin or cocaine, no posterior synechiae,—no ptosis or other signs of involvement of the cervical sympathetic, no glandular tumor in neck. Dr. Wootton thought that the miosis was probably due to a maldevelopment of the dilator fibres. This case had originally been one of myopia, the dislocation of the lenses, apparently spontaneous converting it into hypermetropia. There was no history of injury. Another rather interesting feature was that with her present correction, the best that could be given for distance, she could read Jaeger No. 3 at from 30 to 18cm. This apparent accommodation in an aphakic eye was not accompanied by any further contraction of the pupil. It should also be stated that the pupils reacted actively to light.

Dr. E. S. THOMSON presented a case of **glaucoma following a cycloplegic**. The patient, L. H., 30, female, came to the clinic February 17, 1921, complaining of asthenopic symptoms. She was given a solution of atropin (two grains to the ounce)

and told to return for refraction. February 19th she returned with pupils well dilated, having put atropin in her eyes four times. Her visual tests were: R. V. = $\frac{3}{4}$ w + 2.25; L. V. = $\frac{3}{4}$ w + 2.75.

February 24th she returned stating that for several days past her eyes had felt bad. Examination showed both pupils still dilated, corneæ hazy, slight circumcorneal injection, and the tension elevated, being 60 (McLean) in each eye. She was treated with 1% pilocarpin and eserin (gr. $\frac{1}{2}$ to 1 oz.) and her discomfort lessened, but the pupils did not fully contract or the tension remain normal. March 1st she was admitted to the hospital and kept more closely under observation, but without the desired effect. At times, in spite of all treatment, the tension would rise to 80. It would, at times, reach normal but would soon rise again. On account of the lack of severe symptoms, operation was delayed but a double iridectomy was finally done March 12th under a general anæsthetic. She recovered without incident and the tension has remained normal since. The vision is now $\frac{3}{4}$ —in each eye with a correcting lens.

The question has often been raised in these cases as to whether any constitutional pre-disposition has existed which might have been a factor in causing the attack. The anterior chamber was not particularly shallow before the attack. She was referred to Dr. Houghton for a metabolic study.

Family history negative; recurrent attacks of tonsillitis and frequent nasal colds.

General physical examination: Well nourished young woman, of good color and general healthy appearance, with a possible slight sallowness of the skin. Blood pressure 155. Wassermann negative.

Urine negative except for indican and faint trace of albumin. Blood chemistry normal, except urea (40.32).

The tonsils and the nasal sinuses were found affected and were operated upon.

After the eye operation, there have been slight variations of tension without any significance. The attack of glaucoma was of unusually slow onset and while not of great severity, was certainly most intractable.

DISCUSSION: Dr. Koller says that it is an old experience,

that a cycloplegic and even mild mydriatics as cocaine or euphthalmin cause an outbreak of glaucoma in an eye predisposed to it. It is significant that a dilated pupil goes with prodromal, glaucomatous attack, and that states of hypotension are generally accompanied by a narrow pupil. This connection is by no means satisfactorily explained by the Knies-Weber theory of glaucoma, and the question is, why a dilated pupil necessarily goes with a glaucomatous attack. Dr. Koller refers to the paper which he read at the last meeting of the American Ophthalmological Society on "The Physiological Mode of Action of Mydriatics and Miotics—Explaining their Effects in Hypertension," in which he showed that all mydriatics have a powerful constricting effect and all miotics have a powerful dilating effect on the iris vessels, congesting the same; an effect to which in part dilatation of the pupil (by shrinking of the iris) and vice versa contraction of the pupil (by unfolding and stretching of the iris) is due. In the prodromal or acute glaucomatous attack we have before us a state of oedema of the anterior part of the eye, accompanied by a stagnant circulation in the ciliary system. Proof of this stagnation is relative anaemia of the iris (dilated pupil) and engorged ciliary plexus (dilated anterior ciliary veins—their collaterals). This stagnation of the circulation is relieved by the miotics (including dionin), and also by all other agencies making for a congestion to the head, for instance, sleep, administration of morphin, caffein, etc.

Speeding up the circulation causes lessening of the oedema, thus relieving the hypertension. The stagnation of the circulation is aggravated by all mydriatics, because they contract the iris arteries, and this explains their adverse influence in glaucoma already existing, and perhaps also their precipitating attack in an eye disposed to glaucoma.

But the beneficial effect of the miotics, and the adverse effect of the mydriatics is not confined to the "inflammatory" variety of glaucoma, which is a sort of angioneurotic oedema, caused by an unknown agency. All kinds of hypertension, whether primary (chronic simple glaucoma) and thus of vascular origin, or secondary caused by lens cortex or vitreous body, clogging the circulation after an operation or traumatism, is equally affected by mydriatics and miotics, thus furnishing

additional evidence of the correctness of the theory here propounded.

Doctor HARTSHORNE said he had seen two cases of glaucoma following a cycloplegic: 1. S., 40 years old. Used homatropin cycloplegic twice without ill effect. In 1921 four days after the use of the cycloplegic homatropin, he returned for post cycloplegic examination with acute glaucoma O.D. and O.S. normal. Before cycloplegic had been used fundi and tension were normal (with fingers). Did not respond to medical treatment and after iridectomy had intraocular hemorrhage,—final and present vision $\frac{1}{4}$ with marked cupping of disc. He added in discussion that two drops of pilocarpin 1% had been put in the eyes to counteract the homatropin. Eight years previously he had done an iridectomy for glaucoma on the father.

2. The record of a woman of thirty in whom he did double iridectomy for chronic glaucoma, showed that he had 1 year previously used homatropin without ill effect.

Dr. Rose said, as the administration of a cycloplegic causes the iris to press towards the limbus of the eye, interfering with the free circulation of the blood, lymph and aqueous, in their respective channels, is it not possible that we may be adjudged liable, in a case like this one of Doctor E. S. Thomson's? Would it not be well to make it a daily practice to administer at least two doses of $\frac{1}{2}\%$ eserin before allowing a patient to leave the hospital or office, after administering a cycloplegic?

Doctor C. H. MAY said he rarely uses atropin in the estimation of errors of refraction; children, particularly squint cases, offer occasional exceptions. His routine plan is to employ a 2% solution of homatropin with a 1% solution of cocaine; of this mixture, one drop is instilled in each eye every few minutes for four doses; the patient is instructed to keep the eyes closed for one hour and is then ready for the examination. The effects of the homatropin are neutralized with eserin in every case; one drop of $\frac{1}{2}$ of 1% solution is instilled and this is followed by a similar instillation after a few minutes; the patient is informed of the object of this and of the fact that there follows a somewhat uncomfortable twitching of the lids from the effects of the eserin; unless this is explained there is apt to be nervousness and excitement on the part of the

patient after he leaves the office. The result of these instillations is that the patient is able to resume his usual occupation after a half hour or an hour, whereas, if the neutralizing drops are omitted, the dilated pupils and interference with accommodation will last two days. Dr. May had never encountered a case of glaucoma as a result of a mydriatic or a cycloplegic and he thought that the probable absence of such an accident was due to the regular use of eserin as described.

Dr. COHEN suggested the advisability of making tonometric rather than digital examination of the eye-ball in cases where there existed the slightest possibility of an increase in the intraocular pressure.

Dr. CLAIBORNE said his experience in this matter was practically parallel with that of Doctor May. During that time it had been his custom to use atropin between childhood and thirty-five years—afterward homatropin between thirty-five and forty-five. He had never seen a case of glaucoma following either and he had never used pilocarpin or eserin to cut short the duration of the mydriasis.

Dr. T. H. CURTIN reported three cases of **tumor of the eye-ball and of the orbit.**

Case 1. Melano-sarcoma of choroid and ciliary body in a woman aged 48. She had noticed failing vision in the right eye for the past three months. Vision R. E. Fingers to nasal side; L. E. $\frac{1}{2}\%$ -2.00 cyl, ax 60 = $\frac{1}{2}\%$.

The right eye showed what appeared at first to be an iridodialysis at about 3 o'clock, but on more careful examination proved to be degeneration of the iris, with black pigment showing through. The ophthalmoscope revealed a black mass back of the lens, encroaching half way to center of pupil. Tension—McLean tonometer R. E. 45; L. E. 30.

The eye was enucleated.

The specimen presented was the nasal half of the right eye, revealed a black tumor mass occupying in its entirety the anterior one half of the vitreous chamber, involving the ciliary body and iris and pressing against posterior surface of lens.

Case 2. Sarcoma of orbit. Operation—Exenteration. P. W., age 79. Came to hospital on February 3, 1921, for pain in left eye and a sticking together of the lids, also states that he had a slight bulging of the left eye, but could see fairly well

with it, the proptosis and loss of vision gradually increased, and September 1, 1921, he had proptosis of the left eye with limitation of movement of the globe in all directions. No light perception, and a tumor mass could be felt, particularly on outer aspect of orbital cavity.

X-ray Report—Negative. At operation, complete exenteration of the left orbital cavity was done. The eye with entire tumor mass and periosteum lining the orbital cavity was removed en masse, the tumor was found to have perforated into the ethmoidal cells and into the middle meatus of the nose and maxillary sinus. The skin of the lids after scalping of the cilia was inverted into the base of the orbital cavity and used as skin flaps, these have grown so well that the cavity at the present time is nearly completely lined with skin, except for the two openings, viz.—into ethmoidal cells and into nares, and also into maxillary sinus where the openings are much larger than at the time of operation.

This patient received two radium exposures, each of 20 hours' duration, at Radium Institute, the first, two weeks after the operation and the second, the following two weeks. At the present writing there is no evidence of any return of the growth, the left orbital cavity is nearly completely lined with skin, and it is contemplated to close opening into nares by a pedicle skin graft, sliding it downward.

The specimen as presented shows a tumor surrounding the optic nerve, and the posterior segment of the eye-ball, this before operation filled the entire orbital cavity. There appears to be no extension of the tumor into the globe and although surrounding the nerve intimately, the tumor probably originated in the retro-orbital tissues. Microscopically—mixed cell sarcoma.

Case 3. Leucosarcoma of choroid. W., age 29 years. On Jan. 5, 1918, vision was $\frac{1}{2}\frac{1}{2}$ in each eye and fundi were normal. On Dec. 13, 1920, he complained of a blurred vision in right eye. Vision O.D. $\frac{1}{2}\frac{1}{2}$, O.S. $\frac{1}{2}\frac{1}{2}$.

In the right eye a small white spherical detachment was seen above and out in the periphery of the right fundus.

The intraocular tension was 30 in each eye. Wassermann—negative. Gonorrhreal fixation—negative. Koch subcutaneous tuberculin test—negative.

I advised early enucleation but the patient insisted on taking radium treatment. One exposure was given with no apparent effect except slight reddening of surface of tissues. April 12, 1921, at Bronx Eye and Ear Infirmary enucleated R. E., normal recovery.

Specimen shows a white tumor, $15 \times 12\text{mm}$ occupying the entire anterior segment of the vitreous chamber, in direct contact with the posterior surface of the lens—with no involvement of the lens or iris.

Pathological diagnosis—Spindle-cell sarcoma.

DISCUSSION: Doctor GOLDSTEIN stated that they had two cases of Orbital Tumor on Doctor Wheeler's service at the New York Eye and Ear Infirmary for which an eviceration of the orbit was done at the same time a Thiersch skin graft was applied on rubber tissue to the bare bone. This was then held in place by a Mikulicz tampon. This dressing was left *in situ* for one week. In one of the cases there was a complete take. In the other $\frac{2}{3}$ of the graft had taken.

This method which is Van Noorden's, has certain advantages. It shortens the stay at the hospital, leaves a perfectly smooth surface, and if a recurrence is taking place it can be readily seen, whereas if granulation tissue is permitted to grow it obscures the new growth.

Doctor R. C. DODD reported a case of **keratitis punctata superficialis**. J. W., age 25.

In July of 1919, patient had redness, pain, and watering of the left eye. This persisted for months before he sought treatment and then only because the same condition began to develop in the other eye.

He was treated at various clinics and came under my observation in Nov., 1921, complained of intense photophobia, watering, and pain in both eyes. On examination he showed numerous superficial punctate opacities on each cornea—with one superficial ulcer on his left cornea. No vascularity of the cornea and no deeply situated opacities. On examination of the cornea under the loupe the areas were seen to be sharply defined rounded spots with a central "nucleus" over which the cornea was unbroken and depressed rather than raised.

Wassermann negative, urine negative, nose and throat dep't report enlarged turbinates—deviated septum and a small

amount of pus in the tonsillar crypts. Skin lesions due to acne and at present under treatment at the Vanderbilt Clinic. Tuberculin intradermal test showed a moderately positive reaction (2+) in dilutions of 1-10,000 and 1-1000. Not sufficiently positive to justify tuberculin treatment.

The treatment has consisted of atropin, heat, yellow oxide ointment and quinine grs. 5 t.i.d. with protective smoked lenses.

The case presented shows some variations from the classic description, possibly due to the length of time that the process has been active—(18 months). These variations are: (1) Ulcer formation in left eye, which is now healed. (2) The absence of elevation of epithelium over the areas of infiltration—in fact the epithelium over many areas seems actually recessed. (3) The large size of some of the areas with their peculiar appearance of a central nucleus.

DISCUSSION: Doctor W. B. Weidler does not believe this is a case of keratitis ex acne rosacea, as was suggested, for there is no marked inflammation of the cornea and the periphery of the cornea is not involved.

He has seen a number of cases of keratitis ex acne rosacea and there is often perforation of the cornea with prolapse of iris into the ulceration. A tendency to chalazion formation has been reported by von Hippel.

Dr. DODD reported a case of **retinitis**. P. C. age, 16, has never seen well with her right eye. In April of this year the vision in the right eye was fingers at 2 feet (myopia 19D). The vision in the left eye was $\frac{1}{20}$ made $\frac{1}{20}$ by -1.00 X 10. which glass was ordered. Fundus normal.

In October she complained of blurred vision in her good eye which had come on rather suddenly a few days before. Her vision was $\frac{1}{100}$ and the fundus showed an extensive area of retinitis extending from the disc to the macula, the retina was oedematous and raised about 2-3 diopters. In the extreme periphery there were some other areas of retinitis.

Physical examination negative. Wassermann negative. Urine negative. X-ray of sinuses negative.

Intra-dermal tuberculin test showed a strongly positive 4+ reaction in dilution of 1-1,000. Tuberculin injections begun November 16 with 3 minims of B.E. 1-10,000. In the course

of 2 to 3 weeks the retinitis subsided leaving distinct clear-cut whitish bands resembling retinitis striata, situated below the vessels and extending from the region of the disc towards the macula. At this time an area of proliferating retinitis was seen extending from the macular region forward into the vitreous and some fresh hemorrhages in the periphery of the fundus below where an extensive retinitis still persisted.

On December 20, 1921, the striate bands appear to have disintegrated into rounded spotty areas totally different from the clear-cut white bands that were seen previously. The proliferating strands extending into the vitreous are well seen—as is also the extensive retinitis with hemorrhage in the periphery below and to the temporal side.

There are certain factors in this case that strongly resemble the disease known as Coats' disease of the retina or massive exudative retinitis.

Doctor UNGER showed two cases of **keratoconus**. CASE I. C. S., age 22 years, always nearsighted, influenza 1918, since then eyes rapidly worse. Vision O.D. $\frac{1}{200}$, O.S. $\frac{1}{200}$, when first seen was wearing O.D.-6.50 cylinder, axis 165°; O.S.-6.50 cylinder, axis 180° which gave vision of $\frac{1}{100}$ right and $\frac{1}{200}$ left. Under homatropin, October, 1920, O.D.-0.50 spherical \bigcirc -5.00 cylinder, axis 45° gave $\frac{1}{10}$ plus 3; O.S.-4.50 spherical \bigcirc -8.00 cylinder, axis, 5° gave $\frac{1}{10}$. One year later, October, 1921, homatropin O.D. -4.50 spherical \bigcirc +8.00 cylinder, axis 135°, gave $\frac{1}{10}$ +3, O.S. -2.50 spherical \bigcirc -11.00 cylinder, axis 5°, gave $\frac{1}{10}$.

CASE II. D. L., always nearsighted. Vision O.U. $\frac{5}{200}$ under homatropin February, 1921, O.D. +3.00 spherical \bigcirc -12.00 cylinder, axis 75°, and O.S. +4.00 spherical \bigcirc -8.00 cylinder, axis 85°, gave each eye $\frac{1}{10}$ and both $\frac{1}{10}$ +3.

Doctor WEIDLER reported a case of **altitudinal hemianopsia** due to **occlusion of the inferior temporal artery**. F. C., age 48, on Oct. 20, 1921, drank some "liquor" and a few days later he noticed difficulty in seeing above with the left eye. Six weeks later he came to the Manhattan Eye and Ear Hospital.

Pupils 3mm, react, tension normal, vision O.D. $\frac{2}{20}$, O.S. $\frac{2}{20}$. The ophthalmoscopic study of the fundus at this time showed no changes except a slight pallor of the lower half of the disc. Fields showed a complete altitudinal hemianopsia

except for a small portion of the upper outer field. About ten days later, ophthalmoscopic study of the fundus revealed the lower half of the disc decidedly paler and whiter showing well advanced atrophy. The vessels were all normal in size, shape and color, except the inferior temporal retinal artery, which was contracted. On the disc and at some distance from the disc there is a distinct narrow white line along the vessel wall, showing a partial or complete obstruction of the vessel with secondary obliteration of the vessels. The process is gradually extending along the length of the vessels. The field remains about the same, with increasing atrophy of the disc.

Dr. WEIDLER reported a case of **paralysis of the third, fourth, and sixth nerves** involving all of the extraocular muscles with partial ptosis of the left eyelid. S. R., age 16. Vision O.S. $\frac{8}{10}$ (central corneal opacity).

In November, 1921, struck over the left eye and brow with a hand, which made her "see stars" but later could see better. The next morning when she awoke diplopia noted. After breakfast she was nauseated and vomited, and the same thing occurred the following two mornings. She was unable to resume work, and came to the Manhattan Eye and Ear Hospital, December 3, 1921.

Examinations: O.D. corneal opacity central with nystagmoid movements of the eye, which increased greatly as time went on; vision $\frac{8}{10}$ O.D. $\frac{2}{3}$. There was slight ptosis, which never progressed and paralysis of all of the muscles except the external rectus. Field normal. Urine analysis and Wassermann tests were negative. The X-rays of sinuses showed deviation of the septum to the left with some involvement of the posterior sinuses. Three days later the external rectus became paralyzed. There was a feeling of numbness of the skin over the left forehead and head with complete loss of sensation for heat and cold.

Ten days later movement in the external rectus restored to two-thirds of normal, with slight power of elevation and depression.

The paralysis of the ocular muscles was probably due to a blow which fractured the ethmoid plate of the orbit and was followed by a hemorrhage in the orbit, or there may have been a hemorrhage into the middle fossa of the skull.

The treatment prescribed was hydrarg., bichlor. gr. $\frac{1}{10}$ and potassium iodid gr. X, massage over forehead and scalp. At the last examination there was almost complete action of the external rectus, increased power of elevation and depression, and it would seem that there would be nearly a complete return of motion in all the muscles.

Dr. BEN WITT KEY showed a case of **fat implantation**. C. B., man, 24 years of age, when 8 years old was struck by the end of a wire, cutting and penetrating the cornea of right eye. On April 30, 1921, O.D. no L.P., slightly smaller than normal, divergent, and a menace to the other eye.

Operation was performed on May 8, the four recti muscles being attached in the conjunctival sulci according to the method which I suggested and reported in detail before this Society, December 19, 1921.

There is now sufficient prominence of the prothesis to conform to that of the other eye. The excursions of rotation are all that could be expected of a prothesis, but more important still is the sensitiveness to motion concomitant with the slightest motion of the other eye. The orbit is filled with the fat implant together with well-formed conjunctival sulci, temporal-ward as well as nasalward, without absorption over a period of $7\frac{1}{2}$ months.

This result is due to:

1. The recti muscles are sutured at the sides of the fatty mass and in the floor of the conjunctival cul-de-sacs and, therefore, traction is not made upon the implant but upon the conjunctival attachments of the lids and canthi, thereby allowing normal growth of the fat in Tenon's capsule.

2. Tenon's capsule is entirely filled with one piece of fat from the front of the thigh.

3. The bleeding orbit is not to be irrigated with any solution, nor should bichloride or other cotton pledgets be forced into it. On the contrary pieces of gauze saturated in warm salt solution are placed firmly in the bleeding orbit while the fat is being taken from the thigh. Unusual bleeding is checked before inserting the implant, but the implant is not taken from the leg until the orbit is properly prepared for it.

4. The bandage is firmly applied, the other eye bandaged (when the patient has become entirely conscious from an-

æsthesia) and should remain bandaged for four or five days—; dressing every two to three days with gauze saturated in warm salt solution, rubber tissue being used to retain the moisture.

DISCUSSION: Doctor WEIDLER did a series at the Manhattan Hospital and a third to a half of fat was absorbed. It may have been due to the operation he did. He never lost an implant by sloughing, or infection. He will be glad to try Doctor Key's operation in the future.

BOOK REVIEWS.

III.—The Anatomy of the Human Orbit and Accessory Organs of Vision. By S. ERNEST WHITNALL, Professor of Anatomy, McGill University, Montreal. 8vo., pp. 428. 195 illustrations. Oxford University Press, 35 West 32d Street, New York. Price \$10.

This book arose from lectures given to candidates for the Oxford Diploma of Ophthalmology, and the many dissections and preparations which were used in those lectures are now reproduced by photographs, thereby making this important subject available for general study.

The subject is divided into: a. The bones forming the orbit and their important relations to the nasal accessory cavities; b. The eyelids, conjunctiva, and lacrimal apparatus; c. The contents of the orbit: the globe, ocular muscles, blood vessels, and nerves; d. Appendix: the cerebral connections of the nerves, bibliography, and index.

The description of the cerebral course of the nerves related to the eye, while not necessarily belonging to the orbit, completes the anatomical subject and adds greatly to the usefulness of the book. A complete bibliography of the anatomical articles and books published since 1900 will be of value to investigators.

In the careful and complete elaboration of a difficult subject, Professor Whitnall has placed ophthalmologists under a great obligation; his book should be in the library of every specialist.

A. K.

IV.—Cataract and its Treatment. By LIEUT.-COL. H. KIRKPATRICK (Ret'd), London, late of Madras, India. Pp. 201.

Illustrated, London. Oxford University Press, 35 West 32d Street, New York. Price \$3.75.

Lieut.-Col. Kirkpatrick has given us a short but complete book on cataract, beginning with the anatomy of the lens, its changes in cataract, ætiology of cataract, varieties, symptoms, diagnosis, and finally its treatment by operation. Objections to the intracapsular operation are given as "tissue disturbance," a large percentage of vitreous loss, and adhesions of the iris and vitreous to the wound, which may cause late infections, late attacks of irritation, and glaucoma. For the young surgeon particularly extraction with capsulotomy is safest, and irrigation is regarded as an invaluable aid. The preparation of the patient, the operation, the after-treatment and complications, are carefully described, and give evidence of the writer's large experience and good judgment. The book can be recommended as a safe and conservative guide.

A. K.

V.—Diseases of the Eye. By DR. GEO. E. DE SCHWEINITZ. Prof. of Ophthalmology, Univ. Pa. IX. edition, 832 pp. 415 illustrations and 7 colored plates. Phila. and London. W. B. Saunders Co. 1921. Price \$10 net.

The new edition of this well known text-book has been carefully revised and new subject matter has been added, dealing with new observations of clinical, therapeutic, and operative nature. Important chapters have been rearranged and enlarged. The book is thoroughly up to date and remains one of the best text-books on the eye in any language.

A. K.

VI.—Protein Therapy and Non-Specific Resistance. By DR. WILLIAM F. PETERSEN, Associate in Pathology, Univ. of Illinois, Chicago, with an introduction by Dr. Joseph L. Miller, Univ. of Chicago, Pp. 314. 1922. The Macmillan Company, New York. Price \$4.50.

This book is a comprehensive yet conservative review of the literature relating to non-specific therapy. It begins with a brief history of the development of this new mode of treatment, followed by a description of the various chemical

substances—mostly proteins—which have been employed to bring about non-specific reactions.

At the very outset, and repeatedly throughout the book, Dr. Petersen emphasizes the fact that the theory of non-specific immunization does not in any way contradict the theory of specific immunization; that non-specific therapy does not take the place of specific therapy, but that there are definite indications for each. Each mode of treatment is based on the reaction of the body to injury, and this reaction, Dr. Petersen states, is fundamentally similar under all circumstances, no matter how produced, and obeys all the commonly observed laws of biologic reactions.

His analysis and description of the non-specific reaction is clear and concise. A separate chapter is devoted to a description of the focal reaction—with especial emphasis on the focal reaction in tuberculosis.

The several theories attempting to explain the mechanism of the reaction are given, and the probable nature of the mechanism is explained. The mechanism of recovery in pneumonia, tuberculosis, and typhoid is gone into at some length.

An interesting chapter is devoted to the various skin reactions to infective and protein sensitization, and the probable rôle played by the skin in immunization.

In ophthalmology non-specific protein therapy has been of greatest value in phlyctenular conjunctivitis, trachoma, interstitial keratitis, suppurative keratitis, and iritis. Milk, typhoid vaccine, and diphtheria antitoxin were the proteins most commonly used in the treatment of these diseases.

The book is thoroughly scientific and up-to-date, placing non-specific therapy on a rational basis, and clearly demonstrating, in our opinion, the value of this new mode of treatment.

A. H. T.

OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM.

PRESIDENT: J. HERBERT FISHER, M.B., F.R.C.S.

ANNUAL CONGRESS, 1922.

The next Annual Congress of the Society will be held on Thursday, Friday, and Saturday, 11th, 12th, and 13th of May, 1922, at the Royal Society of Medicine, 1 Wimpole Street, W. I.

The arrangements will be as follows:

THURSDAY, MAY 11th.

MORNING

10 A.M. to 12.30 P.M. Presentation of Edward Nettleship Prize.
Papers.

AFTERNOON.

2.15 P.M. Discussion on "Industrial Diseases of the Eye (Excluding Accidents, Miners' Nystagmus and Glass-blowers' Cataract"). To be opened by Dr. T. M. LEGGE, C.B.E., His Majesty's Medical Inspector of Factories, and Mr. BERNARD CRIDLAND.

4.30 P.M. Tea.

5 P.M. Business Meeting.
Members will dine together in the evening.

FRIDAY, MAY 12th.**MORNING.**

10 A.M.... Papers.

AFTERNOON

2.30 P.M. Visit to St. Bartholomew's Hospital, West Smithfield, E.C.1.
Clinical Meeting. Members are invited to show cases of interest.

EVENING.

8.30 P.M. Tuberculosis of the Eye— Pathological Demonstrations with epidiascope and microscopes. Members are invited to show illustrations, specimens, and sections.

SATURDAY, MAY 13th.**MORNING.**

10 A.M. Papers.

Members desirous of reading Papers, showing Cases or Specimens, or taking part in the Discussions, are requested to communicate as soon as possible with the Hon. Secretary, 14, Portland Place, London, W. 1.

Papers and Communications, subject to the judgment of the Council, will be printed in full in the *Transactions*.

Under the By-laws readers of Papers must not exceed twenty minutes, subsequent speakers ten minutes. The openers of the Discussions are allowed twenty minutes.

All Communications must be type-written.

J. F. CUNNINGHAM
F. A. JULIER } Hon. Secs.

OXFORD OPHTHALMOLOGICAL CONGRESS.

Master, SYDNEY STEPHENSON.

Deputy Master, PHILIP H. ADAMS.

Hon. Treasurer, SIR ANDERSON CRITCHETT, BART., K.C.V.O.

Hon. Secretary, BERNARD CRIDLAND, Salisbury House, Wolverhampton.

Past Master, THE LATE ROBERT W. DOYNE.

February, 1922.

PRELIMINARY NOTICE.

The Oxford Ophthalmological Congress will assemble at Keble College, Oxford, on the evening of **Wednesday, July 5th, next**, and the Meeting will be held on **Thursday, July 6th**, and **Friday, July 7th**, with an extension to the morning of **Saturday, July 8th**, should the programme of the proceedings demand it.

On Thursday, July 6th, a discussion on "THE SIGNIFICANCE OF RETINAL HÆMORRHAGES" will take place, to be opened by Dr. C. A. Hawthorne (London) and Mr. P. H. Adams (Oxford).

Members intending to take part in the Discussion are requested to kindly send in their names to the Hon. Secretary at their early convenience.

The Doyne Memorial Lecture will be delivered on the morning of Friday, July 7th, by J. Burdon Cooper, Esquire, M.D., F.R.C.S.E., the subject being "THE ETIOLOGY OF CATARACT."

The Official Dinner of the Congress will take place on the evening of Thursday 6th, in the Hall of Keble College.

A General Meeting will be held during the Congress at a time of which due notice will be given in the final programme.

It is hoped that members will contribute to the success of the Meeting with papers, pathological specimens, new operations, cases, or novelties of any kind.

Notification of such at the earliest opportunity to the undersigned will be appreciated.

BERNARD CRIDLAND,
Hon. Secretary.

Salisbury House,
Wolverhampton.

ARCHIVES OF OPHTHALMOLOGY.

OCULAR MANIFESTATIONS OF INTERNAL SECRETION.¹

BY PROFESSOR E. FUCHS, VIENNA.

WHEN preparing this paper, I only became aware, how much had already been said and written about endocrine secretion in this country, which, by publishing the *Archives of Endocrinology*, of which a thick volume appears every year, has now taken the leading part in this line.

I have followed the development of the new science from its very start. When I graduated, not even the function of the thyroid was known. The first observations of troubles, following its removal, were made, long before Kocher, in Vienna by Weiss, who described tetany as a sequela of the operation. Eiselsberg in Vienna was the first to study the function of the thyroid experimentally by removing the gland of sheep and the books of Biedl and Falka of Vienna are still to-day standard works on endocrinology.

The ductless glands are innervated by the vegetative nervous system and act through this not on individual organs, but on the tissues. How deeply they may in this way influence the whole organism, is illustrated by gigantism due to hyperfunction of the pituitary gland. But not only the

¹ An address delivered before the City Medical Society of Baltimore and the Ophthalmological Section of the State Society of Maryland, March 29, 1922.

development of the body, but also character, attainments, affections, and sleep have been attributed to internal secretion. Without denying that it may play a part, I think that it is of no use to discuss it as long as no evidence whatever can be brought forward for it. I shall therefore stick scrupulously to those manifestations of internal secretion, for which there exists at least a certain amount of probability.

For evidence to be conclusive, the symptoms of hypo-function, following extirpation of the gland, should be removed by the incorporation of the products of the same gland, and the administration of these to a healthy individual should be followed by the symptoms attributed to hyperfunction. This requirement has been fulfilled only in a very few instances and scarcely ever with regard to the eye. Even the most striking ocular manifestation of hyperthyroidism, the exophthalmus, could only very exceptionally be produced by introduction of thyroid substance.

The *difficulties of investigation* on the subject in hand are mainly due to two facts. The first is, that up to to-day only of two glands has the active substance been isolated, thyroïdin and quite recently crystallized tyroxin of the thyroid, and adrenalin of the adrenals. Of these and of the other ductless glands Abderhalden claims to have recently obtained the active substances in a perfectly hydrolyzed form, which he terms opton. In the second place the correlation, which exists in a stimulating or inhibiting form between the individual glands, makes it impossible to tell, if the symptoms, following for instance extirpation of one of them, are to be attributed exclusively to it or in some part also to one of the other glands influenced by the extirpated one.

Among the *methods of investigation* the *experimental* takes the first place. The most ancient experiment dates from antiquity, showing the sequelæ of castration in man and animals. The counter-test to extirpation is the implantation of gland or the incorporation of gland substance in some form. Another way of evidencing experimentally the correlation between different organs is Abderhalden's method, about the reliability of which opinions are still divided.

The second means of investigation is *clinical observation*. Not most trustworthy is the observation of the clinical symp-

toms and then the study of the changes in the glands after extirpation or after death. Another way of clinical investigation is the observation of the therapeutic effects of the administration of gland substance in various diseases. Modern literature abounds in communications of this sort. In this respect I agree fully with Stewart, who says that the contrast is great, when we leave the desert, where the physiologists and experimental pathologists have wandered, striking many rocks, but finding few springs, and pass into the exuberant land of clinical endocrinology, flowing with blandest milk and honey almost suspiciously sweet.

The beneficial effect of drugs derived from glands is conclusive only, if it has been obtained in numerous cases and with a certain amount of regularity, as for instance the thyroid treatment of cretinism. Otherwise we ought to bear in mind that to cases reported as treated successfully corresponds doubtlessly a manifold greater number of unsuccessful cases, these being as a rule not published. Again, the apparent success may be due to suggestion or to an accidental coincidence with spontaneous relief. And even if the success in a given disease could be attributable to the gland drug, it would by no means be a proof that the disease is due to a trouble of this gland. Haskins is right in asking, whether because cascarkin is efficacious in relieving constipation, we ought to conclude, that this is because the patient is suffering from hypocascarism. The fact that a harmful effect of glandular drugs is extremely rare and as regards the eye is known only of the abuse of thyroid preparations, ought to make us cautious as to their therapeutic efficiency in general.

Contrary to much that has been said and printed on ocular troubles due to the ductless glands, those troubles which occur so often that their relation to the glands may be said to be ascertained are but very few. Many of the ocular symptoms related of cases of glandular disease have been observed only occasionally, so that it cannot be excluded that they may be only indirect consequences of the glandular trouble, as for instance retinal hemorrhages from increased blood pressure in consequence of an excess of adrenalin in the blood. In some of the cases also a mere coincidence is possible. I shall also exclude from the following statements mere

mechanical damages, as for instance atrophy of the optic nerve from pressure by an enlarged hypophysis. I am going now to review the ductless glands, summarizing their action on the eye.

I. The *thyroid* is supposed to act as a stimulant on the thymus, adrenals, and gonads and inhibitorily on the pancreas, hypophysis, and parathyroids. Thyroid preparations have no direct influence on the pupil, only an indirect one in that in cases of Graves's disease the dilatation of the pupil by adrenalin is obtained more easily. Abderhalden asserts that his opton of thyroid together with that of testis contracts the pupil of an excised frog's eye, the only instance of miosis effected by organic drugs. The general action of the thyroid is supposed to be in the main threefold. The first is the *acceleration of metabolism*.

In exophthalmic goiter the metabolic rate is increased, which accounts for the emaciation of such patients in spite of copious feeding. In the eye the accelerated metabolism manifests itself through the intraocular tension. Hertel showed that after intra-venous injection of some cubic centimeters of a 10% solution of chloride of sodium the tension of the eye drops. The increased osmotic tonus of the blood causes water to pass from the eye to the blood by diosmosis, diminishing in this way the intraocular tension. I used this procedure sometimes in cases of acute glaucoma with so high a tension that I apprehended an intraocular hemorrhage at their iridectomy and I succeeded by it in reducing the eye tension considerably, for instance from 60 to 40mm mercury. Again Hertel stated that in animals with symptoms of exophthalmic goiter or fed with thyroid, the injected salt solution disappeared sooner from the blood and the intraocular tension took less time to rise to its former level. On the contrary after extirpation of the thyroid the diosmotic exchange between eye and blood was protracted and the diminution of tension after the injection of the salt solution was less or even nil. Accordingly he found in cases of Graves's disease the tension in general low, averaging 16mm mercury, whilst in cases of hypothyroidism with myxoedema the tension was in the average higher, between 29 and 31mm, and in two of the cases symptoms of glaucoma were present. These latter cases responded to thyroid treatment by a reduction of tension,

in one case from 26 to 16mm, in the other from 40 to 18mm. The relation between glaucoma and thyroid is supposed to be due to the influence of the gland on the salt metabolism. In glaucoma cases the salt in the blood amounted to 0.72% against 1.13% in healthy persons. Also Imre got good results by thyroid treatment in glaucoma and he found the tension lower during pregnancy, when the thyroid is enlarged. Abderhalden by his method found thyroid trouble in glaucoma cases.

Another effect of the thyroid is probably the *destruction* of *toxins*, which are produced by the normal metabolism and poured into the blood. Animals can be immunised against the 2 to 10 fold quantity of various toxic substances by feeding with thyroid. The increase of metabolism and with it of metabolic toxins during pregnancy is counterbalanced by an increased function of the enlarged thyroid. But if this increase of function should remain behind the demand then the toxins might accumulate in the blood and cause general and local disturbances. In this way albuminuria as well as retinitis and optic neuritis, occurring sometimes during pregnancy, have been accounted for. But these may just as well be attributed to the *action* of *toxins* produced in excess by the enlarged thyroid. At least the cases of optic neuritis after thyroid treatment for obesity point in this direction. Birch-Hirschfeld and Inouye observed atrophy of the optic nerves, together with degeneration of the ganglion cells of the retina in dogs after feeding with thyroïdin, just as it can be produced also by other toxic substances such as quinine, salicylates, etc. Also in cases of exophthalmic goiter papilloedema, optic neuritis, and optic atrophy have been recorded.

The ocular symptom most regularly met with in Graves's disease is the *exophthalmus*, but just this has been obtained but very exceptionally by excessive feeding with thyroid. There is no consensus of opinion as yet as to the immediate cause of the exophthalmus and it may even be that it is not directly dependent on the thyroid, but on some other gland influenced by the thyroid. It is especially the thymus which seems to play a part in exophthalmic goiter and cases treated unsuccessfully by extirpation of the thyroid got well after extirpation of the thymus.

The sequelæ of *hypofunction* of the thyroid are well known as myxoedema and cretinism, but the eye is only very rarely affected. Treacher Collins relates a case of myxoedema in which a central keratitis developed, which responded well to thyroid treatment. Then cases of cataract, choroiditis, retinal hemorrhages, and optic neuritis with subsequent atrophy together with myxoedema are on record. After extirpation of the thyroid in man cataract and optic neuritis have been observed, after extirpation in dogs interstitial keratitis. But with regard to the numerous cases of myxoedema, cretinism, and operative removal of the thyroid the recorded cases of eye lesion are so few that it is difficult to exclude indirect action or mere coincidence.

Successful treatment with thyroid preparations has been recorded in cases of corneal dystrophy, chronic uveitis, recurrent hemorrhages in the vitreous body, retinitis pigmentosa, and others.

2. The *parathyroids* are said to inhibit the function of the thyroid. Their extract does not affect the pupil. To date we know nothing about the symptoms of hyperfunction of these glands. The sequelæ of *hypofunction* could be studied only after experimenters had learned to extirpate these glands separately. Before they had always been removed undesignedly together with the thyroid, so that the subsequent symptoms referred to the deficiency of both glands. Nowadays we know that the complete removal of all parathyroids is always followed by death from tetany. If enough of parathyroid substance is left behind to keep the animal alive, the operation is followed by an increased excitability of the nervous system, by a reduction of the lime salts in the bones (rickets), and by nutritional disturbances of epithelial tissues such as hair, nails, teeth, and lens.

As to the nervous system, Falta observed during attacks of tetany an increase of refraction amounting to 3 to 4 dioptries, attributable to a spasm of the ciliary muscle. In the optic nerve neuritis had been recorded in some cases of tetany. With regard to epithelial structures, Hanke found an oedematous condition of the retinal epithelium of the iris as in diabetes and Peters and Possek observed changes in the retinal epithelium of the ciliary body in cases of zonular cataract.

which is supposed to be another consequence of parathyroid insufficiency. It has been known a long time that zonular cataract occurs in children with bad teeth from deficiency of enamel and suffering from rickets and convulsions. These latter have been recognized as being due to infantile tetany and Escherich found at postmortem examination of such children the parathyroids altered. So it is very probable that also the zonular cataract is due to parathyroid hypofunction. Hesse found in 81% of all his cases of zonular cataract symptoms of tetany, and amongst 41 cases of tetany 4 times zonular cataract. Extirpation of the parathyroids in rats is also followed by opacification of the lenses. The tetany in adult persons sometimes causes the development of a soft cataract and the cataract occurring in pregnant women is likewise mostly due to pregnancy tetany. So the correlation between cataract and parathyroid hypofunction is quite definite, but it is still unknown if we have to do with a direct action of certain chemical substances on the lens or with an indirect nutritional disturbance by the intermediary of the altered ciliary epithelium.

According to Fleischer the cataract in cases of myotonic dystrophy is attributable to faulty internal secretion, according to Fischer presenile cataract in general is due to parathyroid hypofunction, and I. Schiotz goes so far as to attribute all cases of cataract whatever to disturbances of internal secretion, but these are but conjectures without the slightest evidence.

3. Of the *pituitary* gland only the anterior glandular lobe has an internal secretion. This is supposed to stimulate the gonads and suprarenals and to inhibit the thyroid. After extirpation of the latter the hypophysis increases in size and so it does under just the opposite condition, namely together with the enlargement of the thyroid in pregnancy. Infundibulin dilates the pupil of an excised frog's eye. Abderhalden's pituitary opton is said to promote the adrenalin mydriasis.

Hyper- and hypofunction of the pituitary gland are followed by very manifold and severe sequelæ concerning the whole body, but no direct action on the eye is known, the affection of the optic nerves in cases of hypophyseal tumor not being due to internal secretion, but to pressure. Experi-

ments with excessive feeding of animals with pituitary extracts did not cause any eye troubles.

4. The *thymus* is supposed to inhibit the thyroid and gonads. Hyperfunction of the gland is presumed to be present in cases of status thymico-lymphaticus and in some cases of Graves's disease. The gland has been found enlarged in some of the latter cases and its removal had a favorable influence on the disease. Implantation of thymus in animals sometimes caused symptoms of exophthalmic goiter. Apart from the eye symptoms accompanying the latter disease no other correlation between eye and thymus is known.

5. The *gonads* stimulate the thyroid, thymus, hypophysis, and adrenals and inhibit the pancreas. The extract of corpus luteum dilates the pupil of a frog, the extract of ovary has no influence upon the pupil. As already has been said, Abderhalden's opton of testis plus opton of thyroid contracts the frog pupil.

A direct influence of the internal secretion of the gonads on the eye could not be found experimentally nor be evidenced by clinical observation. Many of the old observations, for instance of optic neuritis or atrophy from sexual excesses, are inaccurate and others, like the coexistence of ocular diseases with troubles of the menstruation, the recurrence or deterioration of inflammation, the appearance of acute oedema, etc., with each menstruation, are doubtlessly exact, but do not necessarily imply a direct action of the secretion of the gonads on the eye. The function of the ovaries certainly plays a part in the aetiology of Graves's disease, but also here we have very likely to do with an indirect action through the intermediary of the thyroid. Also the therapeutic effects obtained sometimes in eye diseases by gonad extracts must probably be considered as acting only indirectly on the eye.

Certain diseases of the eye are met with predominantly in members of one sex only. So in young men the recurrent hemorrhages in the vitreous body and the familial optic neuritis known as Leber's disease, in older men tabes with optic nerve atrophy. In female patients Graves's disease, interstitial keratitis, and especially chronic uveitis are more frequent than in men. The influence of sex cannot be denied, but it is yet impossible to tell whether the predisposition of

the tissues of the eye to certain diseases is due to a direct action of the internal secretion of the gonads or is effected by the intermediary of other factors.

6. In the *pancreas* an internal secretion is attributed to the islets of Langerhans. It is supposed to inhibit the function of the thyroid, gonads, and adrenals. Nothing is known about an effect on the pupil, nor of the possible consequences of a hyperfunction, only the hypofunction having been recognized as the cause of pancreas diabetes. The ocular troubles connected with diabetes are numerous: paralysis of extrinsic and intrinsic eye muscles, change of refraction, alteration of the retinal epithelium of the iris, cataract, inflammations as iritis, retinitis, and neuritis, finally high grade hypotension in diabetic coma. It is probable that most if not all of these changes bear only an indirect relation to the atrophy of Langerhans' islets.

7. The *adrenals* stimulate the thyroid, hypophysis, and gonads and inhibit the pancreas. Loewi was the first to find, that adrenalin dilates the pupil in diabetic patients, and in patients suffering from Graves's disease. But also in healthy persons dilatation of the pupil can be obtained by a very free application of adrenalin into the conjunctival sac and still better by subconjunctival or intravenous injection.

The function of the adrenals is still very much in the dark. Complete extirpation is always followed by death. But life is preserved if only a small portion of the cortical substance is left, the medulla being completely removed. Similarly post-mortem examination of persons who during life were apparently healthy revealed the destruction of both adrenals except for a small portion of the cortex. Now it is just the medulla which is secreting the adrenalin.

The clinical evidence of increased production of adrenalin is given by increased blood pressure, which in its turn may indirectly entail consequences also in the eye. The clinical symptom of hypofunction of the adrenals is Addison's disease. The eye is as a rule not affected in this disease except for a pigmentation of the conjunctiva recorded in a few cases. Uhthoff describes a particular form of keratitis with Addison's disease. This being to date the only case known, it does not allow of a conclusive assertion of a relation between the two affections.

No ocular symptoms attributable to altered secretion have been recorded in cases of affection of the *pineal* gland.

After what has been said, the eyes are only exceptionally affected directly by alterations of the internal secretion of the ductless glands. It may be that also there exists a relation to internal secretion in the following diseases:

Osteopsathyrosis, frailty of the bones, is as a rule accompanied by a particularly thin, blue sclera. In osteopsathyrosis as well as in osteomalacia the amount of lime salts in the bones is diminished, which may be due to a disturbance of the parathyroids as in rickets.

In cases of *keratoconus* several authors found by Abderhalden's method a relation to ductless glands, but with considerable discrepancy as to which of them. The *green color* of the cornea observed in rare cases of disseminate sclerosis and of tabes may bear some relation to internal secretion. Partial *alopecia* is found sometimes as a consequence of hypofunction of the hypophysis. Therefore such a relation may also exist in some cases of general alopecia, which is sometimes accompanied by iridocyclitis.

Some gland trouble may play a part in *hemeralopia*, in the epidemic cases, occurring chiefly in spring, as well as in the chronic cases in consequence of liver disease. In the latter cases there develops eventually a pigmentation of the retina similar to that in *retinitis pigmentosa*, which had also been attributed to some glandular disturbance.

Internal secretion in a wider sense of the word is not confined to the ductless glands. Every organ pours into its lymph vessels the products of its metabolism, which are different according to the tissues from which they come, and which, being ultimately effused into the blood, act through it on all the other organs and tissues of the body. To be efficient, very small quantities of this substance may suffice, as we see by the powerful influence exerted on the whole body by so small an organ as the pituitary gland. But if there is no doubt about the existence of an internal secretion in the above sense, its manifestations in the individual organs are still in the dark. But besides the general action through the blood stream every organ and every tissue influences the contiguous tissues by the products of its metabolism. This mutual influence

of adjoining tissues upon each other plays doubtlessly a most important rôle in embryonic development. The experimental embryology initiated by Roux has already revealed a great many such correlations, which, as far as they concern the eye, may be reported here in accordance with the experiments by Fischel and others.

In larvæ of amphibia the epithelium of the skin contains besides the epithelial cells particular cells termed Leydig's cells and furthermore pigment granules, either within the epithelial cells or in special cells, the melanophores. But where the epithelium passes from the skin over to the cornea, the pigment granules in the epithelial cells, the melanophores, and the cells of Leydig disappear, because they would interfere with the transparency of the epithelium and be therefore disadvantageous to good sight. Now if you transplant the eye to any other place under the skin, then the above cells and pigment granules will not develop in this part of the skin, or if already developed, will disappear, so that the epithelium becomes like the normal corneal epithelium. It is not even necessary to transplant the entire eye; the lens or a portion of the inner tunics of the eye, nay even the juice of the eye is sufficient for the purpose. This proves that we have to do with a chemical action of one tissue upon the other. The counter test to the above experiments is made by removing the eye, leaving behind only the cornea. Then its epithelium gradually becomes like the epithelium of the skin by developing Leydig's cells and pigment granules or melanophores. This proves that the chemical substances passing from the interior of the eye into the corneal epithelium are indispensable not only for its development as a transparent epithelium, but also for the permanent maintenance of this property.

The chemical influence of the contents of the eyeball manifests itself also on the lens. The lens is formed by a circumscribed proliferation of the ectoderm, where it stretches over the eye, the stimulus to this proliferation being given by the chemical substances emanating from the ocular vesicle. Therefore in larvæ of amphibia a lens may develop practically at any part of the skin, if the eye is transplanted under it, and the size of this lens will depend on the extent of the contact between skin and eye. In these larvæ also the

retinal epithelium on the posterior surface of the iris is capable of producing a new lens, if the normal lens has been removed. Also this is dependent on the chemical influence of the other tissues of the eye. If the iris alone is transplanted somewhere under the skin, it does not produce a lens, but it does so if a piece of retina has been transplanted with it. That they are really chemical substances, to which is due the proliferation of the epithelial cells in such a way that a lens is formed, is proved by the fact that it is possible to stimulate by the exclusive application of certain chemical substances the retinal epithelium of the iris so as to produce a rudimentary lens, just as Professor Loeb succeeded in effecting fertilization of the eggs of sea-urchins in a purely chemical way.

The influence of the chemical substances furnished by the contents of the eye is indispensable not only for the formation of the lens, but also for its maintenance. If the lens of a larva of a salamander is transplanted into another tissue, it gradually disappears by absorption, but if a piece of retina is transplanted with it, it is preserved. The absorption in the first case cannot be attributed to insufficient nutrition, because also in the normal eye the lens is nowhere in immediate contact with blood vessels. Could it be that the senile cataract is due to the fact that the chemical substances, necessary for the maintenance of its transparency, become insufficient with old age?

Evidently the facts found experimentally on larvæ of amphibia could not be simply applied to the human eye. But I may be allowed to describe some conditions which at least remind one remotely of what is so manifest in lower animals, and which cannot be explained except in the same way, namely by the chemical influence of contiguous tissues upon each other.

A recent cicatrix of the cornea is a fibrillous tissue with numerous nuclei. Gradually the latter become less and less and the fibrillæ coalesce so as to form lamellæ, which ultimately may become so homogeneous that under the microscope the old cicatrix looks nearly like corneal tissue, and has also become transparent to a certain extent (clearing up of a cicatrix), a change unknown in cicatricial tissue in other parts of the body. It must therefore be attributed to the influence

exerted by the adjoining structures, either the normal corneal tissue, preserved in the proximity of the cicatrix, or the aqueous humor. The first can be excluded by the fact that the same transformation into a cornealike tissue sometimes also takes place in corneal staphyloma. Now this originates not from the cornea, but from the iris, and the cornealike places are just found in the central parts of the staphyloma, most distant from the rest of the cornea at the margin. So it must be the influence of the aqueous humor and the substances dissolved in it, to which the ultimate transformation of the cicatricial tissue is due.

Another change in an old staphyloma and sometimes even in very thick cicatrices of the cornea is probably caused by the contrary condition, namely an insufficient action of the aqueous humor. In a very thick staphyloma the anterior surface has often a skinlike structure, with papillæ and a thick epithelium with superficial keratinisation. This condition may be found in cases with normal closure of the lids, so that it could not be attributed to exposure and exsiccation. The skinlike structure of the corneal epithelium must therefore probably be accounted for in the same way as the transformation of the corneal epithelium into ordinary epidermis after removal of the eye in amphibia larvæ. We may assume that in a thick staphyloma with its dense tissue the aqueous humor, diffusing into the staphyloma, does not get at the epithelium in sufficient quantity to maintain its normal condition.

Also the above experiments on the lens of amphibia have their analogy in the human eye. After the removal of the lens, out of its capsule, for instance after the extraction of a cataract, some lens matter always remains behind at the equator of the lens and even undergoes further growth by proliferation of the capsular epithelium. This is an attempt to regenerate the lost lens, a process which goes much farther in animals than in the human eye, where develops only a thin ring of lens substance, called Soemmering's ring. This however remains there for a lifetime and a complete absorption of the lens never takes place. On the other hand, if the lens is transplanted under the conjunctiva, as occurs sometimes incidentally in cases of subconjunctival rupture of the sclera, then not

only no attempt at regeneration is made, but the lens is gradually completely absorbed. This is contrary to what one might expect, the nutrition of the lens imbedded in the vascular tissue of the conjunctiva being better provided for than in its normal place, where no vessels get near it. But here it stays under the influence of the substances secreted by retina and uvea, which are absent in the lymph of the conjunctiva.

Another instance is the formation of hyaline membranes within the eye. In the normal eye, Descemet's membrane, the lens capsule, and the basement membrane of the choroid are homogeneous membranes, supposed to be a sort of cuticula produced by the cells that are lying on them. Defects in these membranes may be filled in by a new hyaline membrane after proliferation of the above cells, by which then the new membrane is furnished. But sometimes such membranes form also in other places. In old cases of iritis the iris is sometimes covered by a homogeneous membrane, just like Descemet's membrane. Also from the pigment epithelium originate sometimes hyaline membranes. It reminds one of a sclerosed vessel, where quite a number of new elastic membranes develop often within the connective tissue, which lies on the inner elastic membrane. Just as these elastic membranes are formed under the influence of the blood, so in the eye the hyaline membranes develop under the influence of the substances dissolved in the aqueous and vitreous humor.

RELATIONS BETWEEN EYE AND EAR (INCLUDING THE VESTIBULAR ORGAN)¹

BY PROFESSOR J. VAN DER HOEVE, LEIDEN, HOLLAND.

AS I have to speak to oto-aryngologists as well as to ophthalmologists I, of course, looked for a subject which would divide as well as unite the different branches of medical science. In doing so the first things which appeal to our mind are the relations between the nose and the accessory sinuses to the eye, because these cavities are so close to the orbit and optic nerve. The ear is at so great distance from the eye that it seems nearly impossible that direct influence is exercised from one organ on the other, and yet I, for one, believe that the relations between eye and ear, at least when we include the vestibular organ, are of much greater importance to mankind than those between nose and eye.

My subject may be divided into four parts:

1. Diseases and intoxications, which cause eye and ear symptoms.
2. Eye diseases which cause ear symptoms.
3. Ear affections which give eye symptoms.
4. Relations between the vestibular organ and the eye.

I will try to pass the three former quickly so as to spend the greater amount of my time on the last and most important one.

We all know that there are a great many diseases and intoxications which cause eye and ear symptoms. From the latter we can, for instance, mention intoxications with chinin, optochin, salicyl, wood alcohol, etc., from the former, the well-known ones as syphilis, especially the hereditary form, tuber-

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culosis, scrophulosis, etc. But I only wish to fix your attention for a few moments on some lesser known and yet important diseases; in the first place, on the syndrome of blue sclerotics.

You know that in 1901 Eddowes taught us, in a very short publication, the existence of a hereditary disease, in which the patients have a grey-blue to slate-blue color of the white of the eye, and suffer of brittle bones. That means that they fracture different bones on the slightest occasion as by putting on an overcoat, falling on a feather bed, etc.

Eddowes had previously supposed that this was due to a lack of fibrous tissue. Eddowes's communication was forgotten and later on the facts rediscovered. Since then many authors have produced a great number of accounts of this interesting disease without showing new facts until about four years ago de Kleyn, from Utrecht, and I found that these patients when getting older grew deaf by otosclerosis, or labyrinth affection. At nearly the same time this fact was also found out by an American man named Bronson, who was then in Edinburgh. Since then it has been investigated by different authors.

I am convinced that the sufferers from blue sclerotics have nearly always also brittle bones and ear affection, but in the literature you will find that of those afflicted with sclerotics many have brittle bones, and some of them deafness. This may be caused by the fact that when the blue sclerotics are present it is observed immediately, but brittle bones may pass unobserved when no traumatism occur and patients only become aware of otosclerosis at an older age.

The cause is a maldevelopment of the mesoderm. There are other infirmities which may occur, as arcus corneæ juvenilis, sprains, weak ligaments, etc. The patients often are small, crooked persons. The girl, whose picture I show here, had about twenty-seven fractures of different bones, *e. g.*, of the sacrum, legs, skull, etc. The most interesting feature is the affection of the auditory organ. You know that only a few years ago we thought that the inner ear could not be photographed with Roentgen rays in such a way that the photographs could be used for clinical purposes, but Stenvers, from Utrecht, taught us otherwise. You see here in a skull the inner ear made more visible by filling with lead; here in a skull without that filling you can see clearly the cochleæ, the semicircular

canals, the cavum tympanum, and the meatus auditivus internus. On the next lantern slide you see the same in a normal living person and here in a patient with blue sclerotics and otosclerosis, we find in the place of the inner ear a black mass in which we can only find a few remains of the labyrinth.

We know that in those rare cases the relation of eye and ear is of some value. Then it is necessary when a patient comes to us with blue sclerotics to advise him not only not to take a profession in which he is exposed to traumatism on account of the brittle bones, but also to warn him that his hearing will get worse when he grows older; so that professions in which acute hearing is of great importance, such as telegraphist, marconist, telephonist, etc., had better not be chosen.

In the second place, I wish to mention the eye affections which are often found in congenitally deaf and dumb people, as pigment degeneration of retina either in the form of the well-known retinitis pigmentosa, or in other forms.

It may be of some interest on this account to mention that in the ophthalmoscopical examination of congenitally deaf and dumb animals, such as the Japanese or Chinese dancing mouse, I found in every specimen I could lay my hands on, a pigment degeneration of the retina, sometimes very much like a retinitis pigmentosa, other times more like an old chorioretinitis.

Though this fact is very easily ascertained by means of the ophthalmoscope, the histological investigation is not so easy, but I hope we will be able to prove this fact anatomically, too. At any rate, both facts show a very intimate connection between retinal pigment and deafness.

I shall attempt to give still a third instance of diseases with eye and ear symptoms: We know a peculiar disease under the name of tuberose sclerosis of the brain, in which as a rule young epileptic idiots have tumors and cysts in the brain, heart, kidneys, thyroid glands, and in the skin. I have observed that in this disease may also be found previously unknown tumors of the optic nerve head and of the retina.

Now there is a second nerve disease which we know under the name of the disease of Recklinghausen, which manifests itself by multiple neurofibromata in the skin and in the peripheral nerves and even in the acoustic nerve.

Some neurologists, as Bielschowsky, think that both diseases are one and the same, only with different localization of the tumors and consequently they speak about spongioblastosis centralis, phrenica, and universalis. Nieuwenhuyse, on the contrary, is convinced, that those diseases are two entirely different well-defined affections, not to be classed together.

A few months ago I examined in the clinic of Professor Winkler, in Utrecht, a patient, who was deaf, feeble sighted, and showed atrophy of many muscles. A diagnosis of meningitis, with consequent deafness and muscle atrophy, was made, but when Stenvers made X-ray photographs of the inner ear to find out what was amiss, he discovered on both sides a considerable enlargement of the porus acusticus internus, which, as you can see in these diagrams, enlarged as age advanced, so it was made highly probable that the deafness was caused by a tumor of the acoustic nerves. The patient was reexamined and they found some neurofibromata on his back and in certain other places. The diagnosis was therefore changed to Recklinghausen's disease.

The right eye of this man was already feeble-sighted for many years; there had been a retinal detachment. We found in the retina a huge mass which looked like advanced stage of Coates' disease but it could also have been a tumor mass. At the place of the optic nerve disk there was a tumescence, which could have been a tumor of the optic disk. However, this eye was much too changed to make a reliable diagnosis. The other eye showed a choked disk (5 Diopters) but also in the retina were two small tumors ophthalmoscopically exactly like the tumors in the cases of tuberose sclerosis of the brain.

Though the real proof can only be given by histological examination of the eye, I am thoroughly convinced that this man has the same kind of tumors in the retina as our patients with tuberose sclerosis show. If this proves to be true, it is highly probable that the disease of Recklinghausen and the tuberose sclerosis are the same affection, or are at least very near to each other. Then, too, it would not be accidental that such rare tumors would develop in different diseases. So you see again how important the eye and ear symptoms are. The ear disease enabled us to make the diagnosis of Recklinghaus-

en's disease, and the eye disease can perhaps help to solve this neurological puzzle.

2. About eye diseases causing ear diseases we may be brief, because I know only one: Sympathetic ophthalmia, which is said to be the cause of deafness. The first who observed this fact, Snellen, thought the deafness to be caused by a meningitis spreading from the optic nerve sheaths, because they believed in Deutschmann's theory of the migration of sympathetic ophthalmia along the optic nerve sheaths. Nowadays this theory has become more or less obsolete and other theories more popular.

Peters, who believes that deafness is not a very rare occurrence in sympathetic ophthalmia, tries to explain the deafness by one of the modern theories and he chooses Elschnig's theory, which says that sympathetic ophthalmia is an anaphylactic process in sequence of sensitization of pigment caused by the inflammation in the first eye. Now it is possible that just as the pigment in the second eye, the pigment in the labyrinth is sensitized and causes the ear disease. The individual difference in the amount of labyrinthal pigment can explain why one gets deaf and the other not.

I cannot say that I have often found deafness in sympathetic ophthalmia, but this theory shows again how close a relation is thought to be present between eye pigment and the ear, and I am thoroughly convinced that this relation is a very important one. So we often encounter deafness in albinotic animals, for instance, white cats. As a rule these cats have blue irides, which means that they are not absolutely albinotic, whereas total albinotic cats are not deaf. This is also the case with mice. Totally albinotic white mice are not deaf, whereas the partial albinotic dancing mouse is deaf.

Concerning these relations between eye pigmentation and deafness there are different possibilities:

1. The pigment aberration causes the deafness;
2. The ear disease causes the pigment aberration;
3. Both are independent of each other and may come from the same origin.

The first is perhaps the case in sympathetic ophthalmia. About the second possibility, Peters suggests that the eye pigment may be sensitized from the labyrinth, which gives rise to

a spontaneous bilateral iridocyclitis; this supposition lacks supporting evidence.

von Stein thought that the relation between eye pigment and labyrinth is so close a one that whenever he destroyed one labyrinth in guinea pigs, he observed pigment changes in both eyes; by destruction of the cochlea he could cause pigmentation as well as depigmentation of the eye, so that he supposed there was present in the cochlea a trophic center for the eye.

I cannot believe the relation between ear and eye pigment to be so close and simple, because de Kleyn—in a great number of guinea pigs, rabbits, and cats, in which for another reason one labyrinth was destructed—could never observe changes in eye pigmentation, neither early after operation, nor weeks nor months later. We had the same negative results in observing human beings where the labyrinth was destroyed by disease; so that we came to the conclusion that in congenital labyrinth deafness often, in acquired only very seldom, pigment changes in the retina may be found and that it has not yet been proved that the pigment changes are dependent on ear diseases.

We are already in the midst of our third part; the influence of the ear on the eye. Here I will not speak about choked disk, due to acoustic tumor or otogenic encephalitis or meningitis, but mention some other diseases: In the first place, thrombosis of the cavernous sinus. Every ophthalmologist should always bear in mind that this usually deadly disease may have its origin in otitis, so that as soon as we can make the diagnosis of this terrible disease, or suspect it, we ought to consult with an otologist, because as I know from experience, operation of the ear may sometimes prevent the fatal issue.

Another eye symptom caused by an ear disease, which occurs more frequently, is paralysis of the abducens nerve in otitis media. Some time ago I saw a most striking instance of abducens paralysis caused by otitis media. A village doctor sent a boy with palsy of the right sixth nerve, and the statement that he had observed purulent secretion out of the right ear. When the boy came to Leiden the purulent secretion had stopped entirely and the otologists could not find the least symptom of otitis media, even no scar nor perforation in the tympanic membrane. The boy was taken in my ward and

two days later the purulent secretion reappeared and the paresis was much better. A very small perforation was observed in the tympanic membrane. The secretion stopped again and the paresis was worse. This recurred several times.

What is the relation between the palsy and the otitis? Gradenigo thinks that the palsy is due to a meningitis at the top of the os petrosum; others speak about the pressure caused by inflammatory oedema and venous stasis in the narrow slit of Dorello, where the nervus abducens passes through the sinus petrosus superficialis. I, for one, believe that toxins play a part by spreading of the toxin in the neighborhood of the focus, so that as soon as the free exit of the pus was blocked the paresis was worse because of toxic oedema. It is like the affection of the optic nerve in diseases of the accessory sinuses and like eye affections of dental origin.

To my conviction it is a little absurd to suppose that the toxins are absorbed by the fluids and run around the body to come exactly to the spot next to the focus to exercise their pernicious influence. It is much more probable, and quite according to the fact, to suppose that the least obstruction causes immediate exacerbation and that the toxic influence comes directly from the toxins spreading in the neighborhood of the focus.

The combination of ear disease and abducens palsy may also be found in cases of traumatism, so I show you here the Roentgen photo of a man, who after trauma of the head became deaf and had an abducens paralysis. We see a fracture in the os petrosum passing through the cochlea.

If we know that an otogenic pupillary and an aural palpebral reflex exists, then I think we may be sure enough that in daily practice may be found manifold relations between the eye and the ear worthy of our intense interest and we should always be aware of this in the interest of our patients and ourselves.

Much more important than those direct clinical relations between the real auditory organ and the eye, are those between the eye and the vestibular organ, which, though many of them have already found a place in our daily practice, are not only of clinical interest, but also of a high scientific signifi-

cance, as well from a physiological as from a pathological point of view.

VESTIBULAR ORGAN AND EYE.

The inner ear is composed of two different parts, which, though both are innervated by branches of the acoustic nerve, do not belong to each other. The real auditive organ, the cochlea, is innervated by the nervus cochlearis, and the vestibular organ by the nervus vestibularis. Formerly the vestibular organ was thought to be a part of the auditory organ and many a name still reminds us of this mistake. Since the classic experiments of Flourens, however, we know that the vestibular organ is a part of the organ of equilibrium, and it is only the very close and intimate anatomical relation which gave this organ as a precious treasure to the otologists, though it has become the place of huge mutual interest and the favorite working place for physiologists, neurologists, and ophthalmologists as well as of otologists.

The vestibular organ consists of the three semicircular canals and the two spaces which we call the utriculus and the sacculus. In the ampullæ of the semicircular canals we find the cristæ acousticæ, in which are the nerve endings of the nervus vestibularis in cells with trembling hairs, moving with the motion of the lymph in which they are floating. Every movement of this fluid acts as an excitation to the nerve cells so that those canals are the most excellent apparatus to perceive any motion of the head.

In the sacculus and utriculus we find the macula-acoustical nerve cells on which rests a membrane with calcareous impregnation, the so-called otolithic membrane, which in some animals, for instance, fishes, is so developed that we can speak of a real stone, the otolith.

The otoliths can exercise influence on the maculæ by pressing on the nerve cells or by dragging at them, consequently, the impulse which they cause will change by every change in position of the otolithic organ, and so the otoliths are an excellent organ to perceive a different position of the head in space. Numerous are the theories brought forward and the experiments done to explain the function of the vestibular organ, and

I have only to mention the names of Flourens, Mach, Breuer, Ewald, Kreidl, Kubo, and in recent times Barany. You know how Barany has made our knowledge concerning the function of the vestibular organ of use in our daily practice.

I think that probably the best work which has been done along this line is that done in the last ten years in the pharmaceutical laboratory in Utrecht by Magnus, de Kleyn, and their cooperators. This work is so important that Barany himself is always in correspondence with these Utrecht men to hear whether his hypotheses are confirmed by the fine experiments made at that place.

In the time which remains, I wish to tell you what Magnus found. The experiments were performed on animals—frogs, cats, dogs, guinea pigs, but especially on rabbits—with the purpose of obtaining an exact knowledge of the function of the vestibular organ in these animals and afterward in human beings, in whom these structures are quite different. The first thing which was necessary was to be exactly acquainted with the anatomy of the vestibular organ of the rabbit.

In the anatomical cabinet in Utrecht there were made by de Burlet serial slides of rabbit skulls, reconstruction in wax of skulls, membranous labyrinth, etc., and on the slides was made a mathematical drawing-reconstruction, which was controlled by Prof. Ornstein, with an analytical-geometrical formula system. In this way there was obtained an exact knowledge of the anatomy of the labyrinth of the rabbit.

According to the result of this examination a magnified model of the labyrinth was constructed. It was too large to bring with me but I can show you a model of the otolith apparatus only, which represents their real position in the rabbit skull. The maculae acousticae are represented by these colored plates; the otoliths by these leaden ones. You see that in giving the rabbit's skull different positions in space we can see what the position of the otolith is in any position of the skull. We know that the labyrinth can cause clonic and tonic reflexes in the eye muscles, so that nystagmus is produced by the clonic, whereas the position of the eye in the orbit is determined by the tonic reflexes.

Now Magnus and de Kleyn found that the labyrinth produces also tonic reflexes of the body muscles and they tried to

determine what reflexes were produced by the different parts of the vestibular organ. So Magnus and de Kleyn found that the vestibular organ causes a tonic contraction of the extensors of the limbs, maximal when the head of the rabbit was placed topsy-turvy, minimal when the head had its normal position with the mouth fissure horizontal.

This reflex was thought to be probably due to the utriculus otolith, so we see that the otolith causes the maximal extension of the limbs when it is dragging at the macula, no extension when it is pressing on the macula. The same otolith causes also extension of the neck muscles, with, of course, the same maximum and minimum positions; but there is an important difference between both reflexes.

The utriculus otoliths are in contact with the limbs of both sides, so that when one labyrinth is destroyed the reflex is not changed. Concerning the neck muscles on the contrary every otolith is only in contact with the muscles of one side, so that when one labyrinth is destroyed the reflex causes a bending of the neck. A third labyrinth reflex has as a consequence that the animal tries to bring back his head in the median position as soon as it has left this position. Magnus calls these reflexes Stell-reflexes.

They are probably caused by the main part of the sacculus otolith. Every sacculus otolith awakes a reflex, which tries to press the head in a direction opposite to the otolith. As long as the head is in the medial position, the influence of the otoliths on each side counterbalance each other, but as soon as the head is bent to one side, the otolith of that side is dragging stronger and so stimulating more, the other is dragging less and so stimulating less, so that the lowest otolith produces the greatest influence and presses the head back again in the median position, which he cannot pass, for in that case the influence of the other is gaining in strength as much as the first one loses its influence. If one labyrinth is destroyed the influence of the remaining sacculus otolith is no more counterbalanced and it will press the head to the other side, till the head assumes a horizontal position with the side of the remaining labyrinth above. Now the sacculus otolith presses on its macula and drags no more, so that this is the rest position which was seen in Flourens's experiments.

These reflexes have not only theoretical importance. We can find them under certain conditions in human beings, and they may be used for diagnoses. The reason why these reflexes are very difficult to demonstrate in animals and almost not to be observed at all in human beings, is that they are covered by voluntary movements and by other consequences of brain action. Therefore we can find them in animals the best when they are decerebrated. In human beings we find them when the brain does not act properly, for instance, in some children younger than three and one-half months of age, or when the brain is partly diseased. Magnus and de Kleyn have studied the direction the reflex movement takes, and so we can conclude when the reflexes are present which part of the brain is still acting. These reflexes were found in patients with idiocy, meningitis, hydrocephalus, apoplexy, and coma diabeticum. As a rule it is an ominous sign when these reflexes can be observed in brain disease.

But I should speak about the relation of the eye to the vestibular organ. We said that the vestibular organ can cause tonic and clonic contractions of the eye muscles. The first determines the position of the eye in the orbit. de Kleyn and I tried to determine the different positions of the eye in the orbit when the head changes its position in space. For this purpose we marked the cornea of a rabbit with a cross figure; suspended the rabbit on an operation board, the head fixed firmly in a Czermak clamp. To this clamp was fixed a wire figure, so that when we photographed the cornea we could see by the cross figure and the wire figure if, and how much, the cornea had moved. The photographic apparatus was fixed on the same board.

This operation board was fixed in a wooden frame in such a way that it could rotate on an axis, and this frame again in another frame, so that it could rotate along an axis perpendicular to the first. In this way we could give the head of the animal any position in space we wished. When we turned the whole apparatus around a vertical axis the position of the eyes was not changed at all.

We now made three rotations:

Rotation I. Animal in vertical position, mouth fissure horizontal. Rotation of the animal on its bitemporal axis. Direction of rotation head down, tail up.

Rotation II. Vertical position, mouth fissure horizontal. Rotation of the animal on its occipito-caudal axis.

Rotation III. Animal in lateral position, mouth fissure vertical. Direction of rotation head down, tail up.

We made twenty-five photographs for every rotation of 360° ; the animal was moved every time 15° . We waited until nystagmus caused by the movement was over. At the twenty-fifth determination the animal had come around again to its original position, so that the twenty-fifth photograph controlled whether any change of position due to other causes had taken place. It is clear that many of the positions in the three series are the same and so they controlled one another.

In this way we learned that by changing the position of the head in space the eyes deviate typically in vertical directions and rotate along the sagittal axis. We could not find out a typical horizontal deviation.

You see that the vertical deviation has its maximum when the animal is rotated on its side, that is, the eye of that side as high as possible, the eye of the upper side as low as possible. de Kleyn and Magnus explained this by the action of the main part of the sacculus otolith. Every sacculus otolith is in connection with the rectus superior of its corresponding and the rectus inferior of its opposite eye. As long as the head is in a symmetrical position the influence of each muscle counterbalances the other and so we see no, or nearly no, vertical deviation when the animal is rotating around the bitemporal axis. When, however, the animal leaves the median position, the lower sacculus otolith drags more at its macula, the upper less; consequently the eye of the lower side is turned up, that of the upper side downward.

If one labyrinth is destroyed the influence of the remaining sacculus otolith is not counterbalanced and the eye of the mutilated side is turned down, of the sound side upward. It is only when the head is rotated toward the mutilated side, so that the remaining sacculus otolith presses on its macula and exercises consequently no influence that the eyes return to normal position.

The rotation of the eye, the cyclotropia, is maximal with the point of the vertical to the nose when the nose is turned upward; maximal with the point to the ear when the nose is

turned downward. It was difficult to find out which otolith produced this reflex; neither the utriculus nor the main part of the sacculus otolith can do it. Now Magnus and de Kleyn tried to explain it by the action of the small bent part of the sacculus otolith. This part has not only a separate position nearing the frontal plane, but also a separate innervation; whereas the main part of the macula sacculi is innervated by the nervus sacculus, this part is innervated by the nervus utriculus, so it is no wonder that it has a separate action. When the head is rotated with the nose in a vertical position the small part of the sacculus otolith drags at its macula and gives a stimulus to the musc. obliq. sup. of both sides, so that the eyes rotate to the nose; when the head is rotated with the nose pointing downwards, these otoliths press on their maculae and this produces a stimulus for the obliquus inferior of both sides. When one labyrinth is taken away, the reflex is the same in quality and not in quantity. The weak point of this explanation is that we have here for the first time to accept pressing on the macula as a stimulus, but it is possible that this explanation is good, though I have other objections to it.

This rotating reflex is called a compensatory rotation, because it seems to try to compensate the rotation of the head by the rotation of the eyes. That really the labyrinth is the cause of these deviations is proved by the fact that when we destroy the labyrinths the compensatory and vertical movements disappear when we examine the influence of the head movement without bending the neck of the animal.

I could also show that in the congenitally deaf dancing mouse these reflexes fail, and also in the two congenitally deaf and dumb girls. For the examination of the latter I used a Javal ophthalmometer with a rotatable head rest in which the head was fixed. We first determined the axis of the astigmatism of the cornea and then rotated the head with the head rest, for instance, 10° ; when there is no compensatory rotation the axis of astigmatism is 10° . If there was compensatory rotation of 10° the axis would not have changed; if the axis was changed 3° there must have been 7° compensatory rotation, so we can determine exactly the compensatory rotation in astigmatic human beings and doing so we find that even the least rotation of the head produces compensatory rotation.

This is of importance for the ophthalmologist for it teaches us that we have always to put patients with their heads straight in the ophthalmometer, otherwise we do not find the right axis. This compensatory rotation is probably also the reason why astigmatic people often hold their heads rotated to one or the other side when they do not get the right correction. They try by this movement to rotate their eyes in such a way that they get their eyes in the best position behind their glasses.

We who like to know the cause of things ask ourselves what is the purpose of this compensatory rotation. When years ago this rotation was observed they thought it was to hold the vertical meridian of the eye vertical in every position of the head for better orientation, but this could not be accepted because the compensatory rotation was always less than the rotation of the head.

In rabbits, as you saw, it is the same, but we know that there is another influence which gives compensatory movement of the eyes, namely a reflex produced by the neck muscles. When the neck of the rabbit is bent the eyes rotate. Now de Kleyn examined both separately. The compensatory rotation is caused by the neck: by fixing the head and bending the body of the animal towards the head. The labyrinth rotative reflex was examined by us as described above. If de Kleyn put both compensatory rotations together, he learned, as you see, that a rabbit with the mouth fissure horizontal, head straight forward, could lift its head over 10° or bend it downward over 90° without rotation of the eye because the compensatory rotations compensate fully the rotations of the head.

At first de Kleyn was puzzled to know why this compensation allowed the head to be bent more than 90° and only be lifted 10° , but this was solved easily. It is caused by the fact that the normal position of a sitting rabbit is not with the mouth fissure horizontal, head straight forward, but with the head bent downward 35° so that out of this position the animal can lift the head over 45° or bend downward over more than 55° without the vertical meridian of the eye changing its direction, which is quite enough for orientation in looking for his food.

So we see that in rabbits the compensatory rotation corrects

the influence of the rotation of the head fully and it is probable that in mankind it is an atavism.

Concerning the highly interesting problem of the vestibular nystagmus I must be brief and will only speak about one point. You know there are many excitations which produce vestibular nystagmus. One of them is the irrigating of the ear with cold water, the so-called cold water nystagmus. Bartels holds that this is caused by suppression of the labyrinth by the cold, so that the same nystagmus is produced if one labyrinth were destroyed. Barany on the other hand thinks it is caused by a stream of endolymph in the semicircular canals brought about by local cooling of the labyrinth wall. This cools the lymph at that spot, consequently this fluid gets heavier and it flows off towards the lowest part of the semicircular canal. The lymph stream stimulates the sensory epithelium of the ampulla and causes in this way the nystagmus.

At first Magnus and de Kleyn attempted to determine whether paralysis of a nerve in the internal ear can be produced by cooling of the ear. Now de Kleyn has discovered that in cats the sympathetic nerve for the eye runs through the middle ear, and that irrigating the ear with cold water caused a palsy of this nerve, producing a narrow pupil, narrow eye slit, etc. Consequently, Bartels's explanation is plausible, but de Kleyn and Storm Van Leeuwen could not accept this view, because the nystagmus does not act in the same way as the nystagmus after labyrinth extirpation. Later those two experimenters proved that Barany's theory was right in the following way:

de Kleyn and Storm Van Leeuwen thought that if Bartels was right the nystagmus would be in the same direction in which the head is held. If, on the contrary, Barany is right, there will be an ampullipetal lymph stream when the ampulla is lower down, an ampullifugal stream when the ampulla is higher up than the cooled spot; no stream when the whole canal is horizontal, which means that the nystagmus must change abruptly in direction, when the cooled spot crosses the position in which it is on the level with the ampulla.

To examine this de Kleyn and Storm Van Leeuwen used our rotating operation board and irrigated one ear of a rabbit during the rotation with cold water; they noted the direction

of the nystagmus after every 10° rotation so that a rotation of 360° gave 37 notations. You see here the result which is corrected to show the influence of rotation on the change of action of the musc. rectus internus and externus. In no one of the three rotations does the head assume a position where the horizontal canal is really horizontal, but we can estimate where the nystagmus must change its direction and you see the result is very near what was previously estimated.

In this way it was proved that Barany's explanation is right. In the genesis of cold water nystagmus the cooling of the horizontal semicircular canal plays the principal part.

When we review the different functions of the vestibular organ we find: Tonic reflexes of the body and neck muscles; Stell-reflexes; tonic and clonic contraction of the eye muscles.

We always take it for granted that the tonic reflexes are caused by the otolith apparatus, the clonic by the semicircular canals, but until now this has not been proved experimentally. Whenever they tried to take away the otoliths the whole vestibular organ was spoiled and the same was the case when they tried to perforate and drain the semicircular canals only.

Now de Kleyn remembered that Wittmaak had published experiments in which he put guinea pigs in a centrifuge and revolved them about 2,000 rotations in a minute. The centrifugal power was so great that the otolith membranes were torn and pulled away from the maculæ. Magnus and de Kleyn made use of this. They examined a great number of guinea pigs with reference to every vestibular reflex, then narcotized them, put them in the centrifuge and revolved at the rate of 1000 rotations per minute for two minutes. As soon as the guinea pigs awakened from the narcosis they were again examined as to their vestibular reflexes and this examination was repeated every two days till no further change was noticed. Then the animals were given to the anatomist who examined the labyrinth in serial slides.

Magnus and de Kleyn had made the clinical diagnosis of what had happened in the labyrinth in which otoliths were torn and thrown away and the anatomist made the anatomical diagnosis. They knew nothing of each other's diagnosis till they compared them and in nearly every case the clinical diagnosis proved to be right.

I can show you here microphotographs of the normal otolith apparatus of the rabbit, of otolith membranes torn away, of otolith membranes which were partly torn away, of vestibular organs with large hemorrhages after the centrifuging; and after some experience nearly all diagnoses could be made clinically.

In this way for the first time it was proved what was the function of the otoliths and what of the semicircular canals. The otoliths are the organ for the reflexes of position; the semicircular canals for the reflexes of movement. There was only one surprising fact: The reflexes on progressive movements as lift movements, etc., proved to be caused by the semicircular canals, whereas Breuer had always said this to be absolutely impossible and every one had believed him. Magnus and de Kleyn had already offered an explanation for this fact, but it would take me too long to speak about this now. We cannot say with absolute certainty whether the explanation of the action of every particular otolith described by Magnus and de Kleyn is right, but we know these explanations to be probable, and the facts on which they are based to be true. Others try to explain the otolith action in another way, for instance, Quix, who explains that only the pressure of the otolith on its macula is the acting stimulus.

Mr. Chairman, Ladies and Gentlemen: In the first part of my address I reminded you of the manifold relations between the eye and ear which we may encounter in daily practice, in the second, I dealt with one of the most difficult problems of medical science and therefore I do not flatter myself that every one of you will have understood everything I tried to express, but I am certain I gave you something to think about. You saw that we are not at the end, that how after every solved problem new questions arise which await solution, but I hope you are convinced with me that we are on the right track and will by going on in this way come to know as much of the functions of the vestibular organ, as much of the relation between labyrinth and eye as is given to human beings to know.

THE INTRACAPSULAR EXPRESSION EXTRACTION OF CATARACT.

BY DRs. A. S. and L. D. GREEN, SAN FRANCISCO.

(*With three illustrations in text and three on Text-Plates XV. and XVI.*)

IN operating for the removal of senile cataracts, two distinct methods have been employed.

First—the capsulotomy method as introduced by Daviel and practiced, with but minor changes since then, by the majority of Ophthalmologists.

Second—the intracapsular method, the foremost exponent of which is Lt. Col. Henry Smith, and recently has been accentuated by Barraquer with a different technique.

The relative merits of the two procedures have, from time to time, been thoroughly discussed by the defenders of each, but it is pretty generally conceded that if a cataract could be removed within the capsule with as little trauma and danger to the eye as occurs when a capsulotomy is done, the former would be the operation of choice.

No one can honestly maintain that the capsulotomy operation is all that can be desired. Far from it. The waiting for maturity with its attendant economic disadvantages, the repeated needling in a large proportion of cases, the more frequent inflammations and the greater danger, though rare it is true, but real nevertheless, of losing both eyes from sympathetic ophthalmia, are conditions that do not apply in the same degree to the intracapsular operation. On the other hand, it must be admitted that greater skill is required to perform an intracapsular operation, otherwise the eye is subjected to unwarranted risk.

In a conversation with the late Col. Maynard he called our

attention to the fact that the term cataract extraction, as applied to the capsulotomy method, is a misnomer. It is really a cataract expression. The Smith-Indian operation is also an expression operation. On the other hand, the Hulen and Barraquer vacuum methods, as well as the Stanculeanu and Knapp forceps methods, are extractions.

In attempting to eliminate certain objections inherent in each of the above methods, we have finally evolved a technique for the intracapsular removal of cataract which combines both extraction and expression. From an experience with over one hundred cases we have found it the most satisfactory method that we have attempted. It reduces trauma to a minimum, and in the hands of capable operators, makes the intracapsular operation available in a large majority of senile cataracts.

In developing our method and instruments we have attempted to correct and improve upon the operative methods and instruments heretofore used, by studying the mechanical, physical, physiological, and anatomical principles concerned.

THEORY OF METHOD.

In order to better understand the reason for our technique it may be well to analyze the methods from which it was evolved, namely, the Smith-Indian method and the more recent vacuum operation.

While the object of the Barraquer operation, like that of the Smith operation, is the removal of the lens within the capsule, the effect upon the ocular contents is somewhat different. This is due to the difference in the mechanical principles involved; one depending largely upon expression of the crystalline lens while the other is dependent upon its extraction. In the Smith-Indian operation, pressure is applied at the limbus below, forcing the ocular contents upward and forward. By special manipulation the suspensory ligament is broken and the lens gently massaged into the wound, the cornea is gradually tucked under the lens, which is thus expelled.

As opposed to this, the principle upon which the Barraquer method depends, like its predecessors, the Hulen method described in 1910, and other similar methods, is the applica-

tion of a vacuum cup to the surface of the lens, suction holding the cataract while it is being removed from the eye. Barraquer lays great stress upon the vibrations transmitted by his pump, which he claims break the fibers of the zonula. In our experiments we have found that these vibrations occur in all motor pumps, but not in water pumps or vacuum bottles. The vibrations are caused either by the revolution or shuttle-like action of the mechanism as it exhausts the air, or by piston action in cylinders. But these vibrations apparently cease on the instant that the lumen of the tube or cup is closed. From our experience we are inclined to believe that these vibrations play little or no part in breaking the zonular fibers.

Unpleasant consequences, from a displacement of the intraocular contents, may follow either method, if too much force be used. If too great pressure is exerted by the Smith-Indian method, a drawn-up or hammock-shaped pupil may result. Or an expulsion of vitreous may occur, followed, although very rarely, by a choroidal hemorrhage. Too much traction on the lens and zonula, when using the vacuum method may disturb the tunics within the eye to such a degree that a detachment of the choroid or retina may follow. Or the capsule may rupture, in which event vitreous is apt to be sucked into the tube.

There thus appear certain factors in the two types of operation which are more or less objectionable and which we believe we have eliminated to a great extent, by our technique and apparatus.

We have attempted to reduce, to a minimum, the greatest danger from too much pressure, as in the Smith method, and too great traction of the suction method. This, we believe, we have accomplished by combining extraction with expression and as these forces act on the eye in a complementary manner, they tend, largely, to neutralize the trauma produced by each. To illustrate our point: If, for example, it would take 20mm of Hg to dislodge a certain weight from a receptacle by traction, then if 10mm of pressure were applied from underneath, it would reduce the lifting power required to 10mm. Or if 20mm of pressure alone were required to raise it, then if 10mm of traction were used, it would reduce the pressure to 10mm. In other words, the 20mm of pressure or traction when each is used alone would be reduced, if combined to 10mm each. This

principle we have applied to the removal of cataracts. Instead of using pressure alone, as by the Smith method, or traction alone as by the Hulen or Barraquer methods, we combine extraction with expression in the manner to be described, with the result that the disturbance to the intraocular contents is reduced to a minimum.

Before taking up the technique of the expression extraction intracapsular method, we will briefly consider some of the instruments heretofore employed and our reasons for modifying them or devising new ones.

VALVE AND CANULA.

There are certain mechanical inconveniences in the Barraquer apparatus, that interfere somewhat with the delicacy of manipulation. In his canula the vacuum system is opened or closed by pressing on the valve with the thumb. This must, of necessity, cause a cramped position of the hand, and all the time the vacuum is maintained, that pressure must be applied

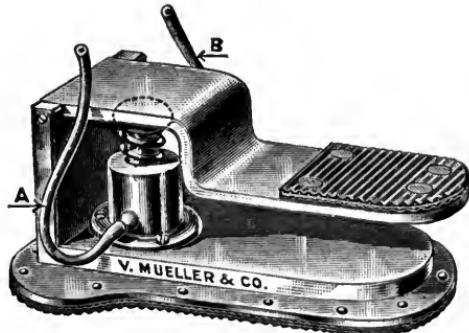


FIG. I.—Floor valve.

until the cataract is extracted. This interferes with tactile and muscle sensibility of the hand, and in an operation as delicate as is required to extract a cataract, is certainly undesirable. Furthermore, the mechanism required for such a perfect valve as the Barraquer instrument possesses, makes the instrument heavier than it should be. The objection to the valve in the canula applies also to an opening in the canula, with the finger acting as a valve, as devised by McDannald.

It is of the utmost importance that the hand and fingers be absolutely free from restraint of any sort.

With these objections in mind, we have devised a floor valve (Fig. 1) to be controlled by the foot of the operator, thus eliminating the valve in the canula. We have incorporated an air vent in the valve, which permits the motor to idle, without the danger of drawing oil from the pump into the canula, as sometimes happens in the Barraquer apparatus. By transferring the valve from the canula to a foot valve, it permits the use of a very light canula, that is held in the fingers as delicately as a cataract knife (Fig. 2). We have made the cup round



FIG. 2.—Canula.

instead of oval so that a larger area of the lens surface will be grasped with less danger of rupturing the capsule. A circular cup will more easily adapt itself to various spherical surfaces than will an oval cup and will require less accuracy in application in order to have all parts of its circumference touch the lens. If a cross section be made of the cup it will be noticed that the edge resembles, somewhat, the half of a dumb-bell, giving a slight rounded depression inside of the cup immediately back of the edge. In other words, the diameter of the opening is a little less than the interior of the cup. When suction is applied, the lens and capsule will conform to this depression, giving a better hold on the cataract. This is important, as the indentation produced in the lens by this edge prevents the cup from sliding on the surface of the cataract after suction is produced. It is also important to eliminate all sharp edges from the cup as these may cause a rupture of the capsule.

PUMPS.

One of the most important factors in the vacuum operation is the manner in which the suction is produced. It is essential that the vacuum should be formed gradually and not too rapidly

to permit the lens and capsule to mold into the cup. A sudden vacuum, even of low degree, may rupture the capsule more easily than a high vacuum working more slowly. On the other hand, when a vacuum is formed too slowly, the operator is apt to attempt extraction before sufficient hold on the lens has taken place.

Various pumps have been used at different times, but it seems with little regard to their action. Not only must the vacuum be sufficient but the time in which a given pump will produce this, is important. In experimenting with various pumps we have found that water pumps, vacuum bottles, and similar devices are more or less objectionable because of the variability of the factors that produce their vacuum, so that the speed and force of the latter is not easily controlled. The speed with which a column of mercury rises will vary with the quantity of air it has to exhaust. The longer the tube and the larger the lumen the longer it will take to produce the vacuum; conversely, the shorter the tube or smaller the lumen the more rapidly the vacuum will be produced.

When the apparatus is completely assembled for operation, the canula, foot valve, and rubber tubing contain a larger amount of air to be exhausted than that at the pump and it will accordingly take a longer period of time to raise the column of mercury at the cup than at the pump itself. With the apparatus assembled for operation an efficient pump should raise a column of mercury to at least twenty-five inches in about ten seconds. The surgeon must familiarize himself with the length of time it will take to produce sufficient suction to hold the cataract. This can easily be done by making use of a finger cot filled with water to practice on.

To simplify the mechanism of the pump, and make it as near as possible fool proof, we have had one made to comply with the above requirements. It is very compact, raises a column of mercury to the desired height and by working in mercury instead of oil, it eliminates the necessity of the frequent inspection and filling with oil. After once filling the pump with mercury it requires very little attention. The construction of the pump is so simple that it does not require the delicate handling that one has to use with an oil pump.

PRESSURE FORCEPS.

For raising the conjunctiva flap and cornea to permit of the introduction of the canula, we have devised a pressure forceps which also takes the place of the Smith delivery hook (Fig. 3).

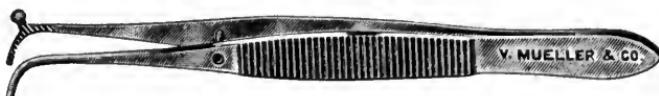


FIG. 3.—Pressure Forceps.

It does away with the handling of an extra instrument and thus diverting the surgeon's attention from the field of operation. This we have done by soldering a ball to the convex edge of one limb of a pair of light curved dressing forceps.

LID CONTROL.

For the control of the lids we prefer the eye speculum which we devised about eight years ago. With this speculum the lids can be held away from the eyeball and the danger from lid pressure greatly minimized, at the same time giving an unobstructed field of operation. It combines within itself in a large measure the relative safety of the lid hook with the greater exposure of the ordinary speculum. Care must be taken to so hold the speculum by steadyng the hand holding it against the patient's cheek, that the blades will just miss the eyeball.

TYPES OF CASES SUITABLE FOR THE INTRACAPSULAR OPERATION.

As a general principle which must not be overlooked, only certain types of eyes are suitable for intracapsular operation. The facial characteristics of the patient give valuable information as to the results one may expect in a cataract operation. All things being equal, patients with cadaverous or deep set eyes, wide palpebral fissure and lax lids, afford the greatest safety. The more prominent the eyeball the greater the danger. A little reflection on the mechanics involved, will show the reason for this. In a deep set eye the lids and brow can exert very little direct pressure upon the globe, because of poor leverage. On the other hand the lids and brow possess a

great deal of leverage on protruding eyeballs. In addition to this, the recti muscles seem to exert great traction upon the globe, so that occasionally one may actually see the recession of the eyeball within the orbit, at some stage of the operation. All of this combines to increase the intraocular tension, so that when the eyeball is cut open there exists a far greater danger from expulsion of the intraocular contents than is the case in deep set eyes. In some of these cases of prominent eyes or tense lids, or where the palpebral fissure is narrow, we have found it of great advantage to do an external canthotomy immediately preceding the corneal section. With the method we employ to anæsthetize the lids it is a simple matter to do this and healing has occurred when the first dressing is done eight to ten days later. As far as possible, the intracapsular operation should be limited to senile cataracts. The older the patient the more easily will the suspensory ligament break and the lens be delivered. Congenital, juvenile, or traumatic cataracts, unless dislocated, should not be attempted by this method.

Among the many patients who present themselves to the ophthalmologist for relief, is that peculiar type of nervous individual whose lids twitch at the slightest provocation; the mere instillation of a drop into the eye or touching the lids with the finger, causes an involuntary spasm of the brow and lid muscles. These patients are apt to exert so great a pull on the globe with the recti muscles, that it may be difficult to steady the eye with the fixation forceps when making the section, and a tear in the conjunctiva may result. Such patients invariably exert great pressure on the speculum, and at any stage of the operation, from the incision to the completion of the toilet, are apt to expel vitreous. An important sign that frequently appears and serves as an indication as to whether or not to perform an intracapsular operation is the condition of the cornea upon completing the section. In the average case, the cornea resumes its normal contour, but when there is considerable negative pressure the cornea is apt to flatten out or even to partially collapse. This is the safest kind of an eye for an intracapsular operation. On the other hand, the wound may gape or there may be a horizontal furrow in the cornea, due to the intraocular contents being forced towards

the wound. Expulsion of vitreous is imminent in these cases and there should be no time lost in doing a capsulotomy and closing the eye without much toilet and without irrigating the anterior chamber. Here we might also mention that the patient is much more nervous and difficult to handle when operating on the second eye than when the first cataract was removed. Early in our experience with the suction operation, we found that we had to eliminate, in the majority of cases, the tumbler or Morgagnian cataracts from this procedure. Under this type must also be included the swollen lens, which is an early stage of the Morgagnian cataract, and is indicated by the very shallow anterior chamber and the pearly homogeneous appearance of the cataract. The capsules of these cataracts are so friable that the application of the cup of the canula to the surface of the lens almost invariably breaks the capsule. The effect is usually a partially dislocated lens, combined with a poor capsulotomy, with the lens matter, which is very difficult to remove, scattered about in the anterior part of the eye. Such cataracts should be removed by the Smith-Indian tumbler procedure, or a capsulotomy done and the lens matter thoroughly irrigated from the anterior chamber.

We find the above indications of considerable value and would suggest that the ophthalmologist, not familiar with the intracapsular operation, choose the safer types of case before attempting the more difficult ones.

The preparation of the patient is all important for a successful cataract operation. The patient must come to the operating table as fully composed as possible and during the operation must suffer little or no pain. It is probable that the pain produced during the iridectomy has caused as much disaster to eyes as anything in cataract surgery. But this danger can be practically avoided by partially paralyzing the lids and the elimination of pain by the deep orbital injection with novocaine.

PREPARATION AND TECHNIQUE OF OPERATION.

Having decided that the case is suitable for the intracapsular operation, the brow is shaved and lashes cut and the patient is assured a good night's rest with a sedative, the night

before. The following morning the lids are injected with two or three *cc* of a 2% novocaine solution, the external canthus being also injected to permit of a canthotomy if found necessary. One *cc* of the same solution is injected deep into the orbit, through the skin of the lower lid, immediately above the lower orbital margin. For this purpose a four *cm* needle is used and directed backward and slightly upward towards the optic foramen, so as not to strike the bony floor of the orbit. We have found this procedure of inestimable value, not only in controlling pain but also in helping to control the nervous movements of the eyeball and lid. Sufficient time must be given for the anaesthetic to act so that the injection is given while the patient is in his bed, forty-five minutes before operation. One drop of a 5% cocaine solution is dropped in the eye every five minutes for six or eight doses, the eye being kept closed between installations to prevent drying of the cornea. One drop of 1% atropine is also instilled to cause the pupil to dilate. The field of operation is sterilized with benzine, iodine, and alcohol and the conjunctiva flushed with 1-4000 bichloride solution. The vacuum apparatus is then tested by applying the cup to a finger cot filled with water, to see if the suction is in working order.

The speculum is inserted and a full half section of the cornea with a conjunctival flap is made and an iridectomy done.

The motor is turned on, the conjunctival flap is grasped with the pressure forceps in the left hand (Fig. 4) and the cornea raised while the canula, held in the right hand, is introduced and lightly placed upon the cataract. The valve is now engaged and a few seconds allowed for the spoon to become firmly attached to the anterior capsule, and the lens to mold itself within the cup. If this time is not given, the spoon will simply slide off, necessitating repeated attempts to hold the cataract. When satisfied that the lens is being firmly held, the left hand releases the conjunctiva and the pressure forceps which held it is shifted to the lower part of the eye, near the limbus (Fig. 5). The cup is raised so that the upper border of the cataract will be tilted forward into the wound at the same time drawing the cataract out of the eye. At the moment when the traction for the delivery of the lens starts, the delivery forceps is pressed gently on the lower part of the cornea, at the limbus, as in the

Smith operation, and followed up as the lens is being delivered. This tends to hold the vitreous back while forcing the lens out of the eye. We thus obtain an expression extraction with a division of the forces in each. The resultant trauma is not only less than that produced by the Smith or suction method, but also much less than that which frequently goes with the ordinary capsulotomy. The intraocular contents are disturbed to such a slight degree that little or no toilet is needed. The pillars of the coloboma seldom need replacing. All that is necessary is to smooth out the conjunctiva, put some mild antiseptic salve between the lids and the eye bandaged. This elimination of doing an extensive toilet is very desirable, as the sooner an operated eye can be closed the better. A hammock-shaped pupil seldom occurs nor does the iris become drawn up.

THE PRESENT STATUS OF VACCINE THERAPY IN
EYE DISEASES WITH SPECIAL REFERENCE
TO AUTOGENOUS VACCINES—REPORT
OF CASES.

BY DR. L. HERBERT LANIER, TEXARKANA, ARKANSAS.

VACCINE therapy for various pathologic conditions of the eye presents a broad field for research and experimentation and one replete with possibilities. Its value has been proven by numerous investigators and I am convinced that vaccines should be more generally employed as a curative agent by Ophthalmologists everywhere and would be if the working theory of opsonic therapy were more generally understood and appreciated.

It has been found by experience that normal blood varies but little in opsonic strength, while in individuals who are infected the opsonic strength is materially lessened. The opsonic index is founded upon the ratio borne by the number of bacteria which become ingested by the leucocytes in infected individuals to that of the normal or healthy person. Reduced to percentage: If within a given time ten bacteria are ingested by the leucocytes in health while but five bacteria of similar type are ingested by one infected, the opsonic index of the one infected is 0.5.

The opsonic index is increased by injecting into the infected person dead cultures of the particular type of microorganisms (preferably from his own body) from which he is suffering. The earlier claims made by those who have experimented widely, notably Wright and Douglas, seem to be established, marking an epoch-making advance in therapeutics.

Phagocytosis has opened new therapeutic vistas and the

part played by infection in pathology has completely revolutionized our treatment. We know that antiseptic agents can not at all times be relied upon to combat the infective elements, especially in ophthalmic practice; hence our interest in any serum or vaccine which may neutralize microbic intoxication. The number of bacteria which can be ingested by the leucocytes depends upon their preparation by substances present in the plasma of the blood, known as opsonins. Opsonins are supposed to exert some influence upon bacteria by which they become prepared for ingestion by the leucocytes.

Of course, we do not at present possess a specific antitoxic serum to fight each infective malady. According to the law so well established by Pasteur the ideal method of treatment would be to oppose each infective disease with a specific serum; but certain vaccines do possess in addition to their purely specific action, therapeutic properties that may be utilized in other infections.

Paraspecific serotherapy:—Now if one is not prepared to accept paraspecific serotherapy as being worthy of trial in ocular infections then he must wait, perhaps too long, for a specific vaccine for each infective malady. It cannot be doubted that a specific serum such as that of diphtheria will have more chance of success in a diphtheritic infection, but, the same serum is sometimes found to be active against other infections, as the streptococci, staphylococci, meningococci, colon bacilli, etc.

An animal actively immunized against a toxin as potent as that of diphtheria or tetanus will have all the anatomic elements placed in a state of defense distributed each after its manner in the circulation; antitoxins, immunisins and antibodies. It is easy to conceive that the serum of such an animal will be rich in elements of defense of all sorts, and injected into an individual with an infective malady, no matter what the nature, will assist him to overcome the particular ailment.

In ocular affections it is not to be supposed that the practitioner will content himself with general, specific, or paraspecific treatment, neglecting local measures. Even if he should employ several measures without knowing exactly what has been the curative agent, it is better than to run the risk of a specific vaccine acting inadequately or too late.

In all nondiphtheritic infections of the eye a polyvalent vaccine may be injected as per indications. If improvement is not marked after three or four injections, during the interval there is time to cultivate the microorganisms present in the eye; for example, the staphylococcus, an autogenous vaccine is made and injected replacing the paraspécific treatment by active immunization with a sterilized culture of the staphylococci.

We shall outline those procedures which give most promise of permanency avoiding dogmatic statements. However, the advances in serum and bacterial therapy have been so rapid in the past few years that for one who has tested the potency of these remedial agents a tendency to be overenthusiastic is always noticeable, but if one were limited to a statement of the trend of scientific and clinical research, still a great deal of illuminating and valuable data may be presented which if given due consideration may lead to greater conquests in our battle against ocular disease.

Simon Flexner (2) is not very optimistic concerning the curative properties of "vaccines." He says, "Their main field of usefulness is protective, and although they induce active immunity, their effect is not enduring. The length to which this protective vaccination may be successfully and properly carried has not yet been determined. The outstanding success is typhoid para-typhoid vaccination, but other successes relate to cholera and possibly to the type pneumonias. The curative value of vaccines on the other hand, is a subject far less easily dealt with. The idea that vaccines can be used to combat generalized infections, because when injected under the skin they utilize the local tissues to elaborate healing immunity substances (antibodies) is a mere hypothesis that has never been verified. The lymphatic internal organs are the only ones known to be active in producing them and hence the inoculation of killed cultures or 'vaccines' in acute infections may merely amount to the adding, as it were, of fuel to the flames. And what in this respect is true of the bacterial bodies as a whole, as they exist in the vaccines, is true also of extracts or other preparations made from them."

Please note this significant statement by Flexner, which

while not contradicting his position as given above, yet is encouraging to those who believe in the efficiency of vaccine therapy: "Although an active antistaphylococcic serum has not been produced, still staphylococcus vaccine is therapeutically valuable in furunculosis, etc." Elsewhere in the same article he says, "Bacterial vaccines also have a limited therapeutic application in certain types of local infection, as furunculosis."

In a series of cases treated during 1920 and 1921, we have found in various infective eye diseases more favorable results after injections of stock vaccines or serum, both the specific and paraspécific products having been used rather extensively to which I shall refer again in this paper.

George H. Weaver has made some interesting observations concerning serum and vaccines and his preference for auto-gogenous vaccines prompts me to quote him at length. He says: (3) "Streptococcus vaccines should always be auto-gogenous. The importance of this is more apparent as the study of streptococci by more refined methods has shown that there are many strains of streptococci which differ among themselves in essential immunologic peculiarities. A vaccine prepared from one strain might be worthless against an infection by another one. There is nothing to say in favor of a polyvalent streptococcus vaccine supposed to be active against all types of streptococci. In multiplying the strains, the quantity of each becomes so reduced that the essential one, if present, is in such small amount as to be without therapeutic effect."

Streptococcus vaccines are contraindicated in acute and general infections. In these circumstances the body is already exerting all its powers to produce antibodies to counteract the infection. The addition of still more bacterial toxin results only in harm. In streptococcus septicemias vaccines are useless. In subacute and chronic local streptococcus infections, autogenous vaccines, given subcutaneously, sometimes act very favorably. This is especially true of infections of mucous surfaces unassociated with accumulations in poorly draining cavities. The initial quantity should be small (from ten to twenty million) and in subsequent injections the amount should be gradually increased. Moderate local reaction is desirable, but general symptoms usually indicate that the

dose given has been too large. The reaction from one injection should subside completely before another is given.

The experience of ophthalmologists who have given vaccines and sera a thorough trial quite often conforms to the views expressed by May as follows: (4) "Vaccines and sera are valuable agents in suitable cases of ocular disease. When possible, an autogenous vaccine should be made. When this is impracticable, stock preparations may be used. Gonococcal vaccine gives excellent results in gonorrhreal iritis. Less certain effects in purulent conjunctivitis, staphylococcal vaccine may be of service in obstinate examples of phlyctenular affections. Autogenous vaccines sometimes initiate a rapid cure of ulcers of the cornea and hordeola and are occasionally useful in dacryocystitis and post-operative infections. Antitoxins are indispensable in diphtheritic conjunctivitis. An anti-pneumococcus serum may be of service in the early stages of infected corneal ulcer. Tuberculin is very extensively used in tuberculous eye affections, often with brilliant results."

I have given much study, experimentation, and clinical employment to vaccine therapy in ophthalmic practice and the time-honored measures of proved worth have never been wholly abolished in treating the various diseases, except in a limited number of cases. I have considered bacterial therapy as a valuable accessory in treatment. It was never intended to be, nor will it ever be a cure-all. Nevertheless, in certain classes of cases the results have been consistently so striking that the value of inoculation by dead bacteria is undeniable.

Autogenous bacterins are always to be preferred to the stock preparations, and success or failure frequently depends on this fact. Although the duration of the period of greatest potency of bacterins is undetermined, the best results have been obtained when the pus has been recultured and a fresh bacterin prepared every two to four weeks.

Thomas arrives at the following conclusions as a result of three years of experience in bacterial immunization (5). "It is believed that the best effects therapeutically, particularly in chronic cases, occur when the quantity is slowly and cautiously increased, thereby, as has been thoroughly demonstrated in tuberculin therapy, avoiding hypersusceptibility or anaphylaxis."

Sherman's observations are interesting. He says: "Immunity assumes two forms, local and systemic. A local immunity is manifested by the development of a local resistance to certain infecting organisms while other parts of the body, composed of the same variety of tissue, are still susceptible to the infection. This is well illustrated in a case of erysipelas. Here the inflammation subsides (8) first where the infection started, but continues to extend into new territory until it finally dies out." This shows that during the infection a localized immunity does not influence the surrounding tissue sufficiently to prevent its extension until sufficient antibody has been absorbed from the tissues in the affected area to develop a systemic immunity, when the infection can no longer extend. It may be aroused when attacked by invading organisms for self-protection. In addition to this localized tissue resistance antibodies formed in any part of the body may, by means of the circulating medium, be conveyed to all parts of the body and render the entire body immune.

In the treatment of eye infections with vaccines, the question naturally arises whether immunizing substances which are developed in other parts of the body can be conveyed by means of the blood to the nonvascular structures of the eye, as cornea, lens, vitreous, etc. To answer this question, Morax and Soiseau (6) made some investigations with animals immunized to diphtheria and tetanus. They found that the aqueous in healthy, highly immunized animals contained proportionately less antitoxin than the blood serum of the same animal, but on retapping they found the antitoxin content of the aqueous very much increased. This shows that the increased blood supply incidental to the traumatism caused by withdrawing the fluid from the interior of the eye enlarged the channels enough to allow free access of the antibody in the blood to the nonvascular structures of the eye. Irritation due to an infection will similarly increase the supply of the immunizing substances contained in the blood to the nonvascular structures of the eye. From this it would seem advisable to apply immunotherapy in infections which involve the nonvascular structures of the eye. When infecting organisms gain lodgment in the tissues where immunizing substances are not readily available, the infections are liable to

become destructive in character. This applies with unusual significance to the eye, in view of the importance of the organ and the amount of serious permanent damage that may follow even a small amount of tissue destruction. It does not require much of a central corneal ulcer to permanently impair vision. Let us take for example a corneal ulcer due to the streptococcus or pneumococcus, in a case where the immunizing resistance to these organisms is comparatively low. A corneal ulcer is necessarily too small a lesion to arouse a systemic reaction enough for sufficient production of antibodies that an adequate amount of them will find their way to the eye and destroy the infecting organism before irreparable damage is done, but by injecting a bacterial vaccine under the skin a very large amount of tissue, as compared with that involved in the corneal infection, is actively called into service for antibody production. This antibody is then conveyed by means of the circulatory system to the infected cornea and aids in destroying the germs long before it would have been possible for the infection in the cornea to stimulate an equal amount of antibody production. What is true of corneal infections applies equally to infections of other nonvascular structures of the eye.

In eye infections it is always advisable to make a bacterial examination because infecting organisms may be present that have a distinct tendency toward chronic infections when a corresponding stock vaccine or an autogenous vaccine should be employed.

Teulieres (7) has used antidiphtheritic serum in eye affections of an infective nature, especially in hypopion keratitis. He found that it was a curative agent; often, however, only a useful adjuvant to the usual methods employed in these conditions. It should be used subcutaneously and as soon after infection as possible. It may be employed as a prophylactic measure. His results show that it ameliorates the pain, checks the progress of the infection, and favors the absorption of the infiltrate and exudate and the formation of new tissue.

Zimmerman (8) has employed Behring's diphtheria serum in a series of cases of inflammatory and traumatic conditions of the eye. When the initial dose is 1500 units, he finds that in many cases only one injection is required to bring about a

cure. If 1000 units were first used the results were less favorable and a repetition of the dose did not have nearly the effect of a large initial dose. If early beneficial effect is not noted, no further improvement will result from repeated injections. In no instance was any complication noted, no skin exanthemata nor any subjective disturbance. He says that while there were some cases in which a combined local and serum therapy was employed he is convinced that eyes were thus saved that would have been lost notwithstanding energetic surgical treatment alone. The list contains cases of infected corneal ulcer, post-operative infection and severe iridocyclitis, traumatic cataract, gonorrhreal iritis, orbital cellulitis, two large septic ulcers of the cornea and a purulent dacryocystitis.

George S. Derby (9) gives an exhaustive review of vaccine and serum therapy in ocular tuberculosis. He believes that beneficial results may be obtained with all the standard preparations. On general principles, however, the filtrates or solutions, such as Koch's old tuberculin T. O. and those of Deny's B. F. and Beraneck's T. B. K. are safer for the beginner, more uniform in their dosage, and less likely to cause noticeable reaction than are the emulsions of vaccines T. F. and B. E.

Derby records 30 cases of ocular tuberculosis treated by tuberculin, 15 of sclerokeratitis, 9 of interstitial keratitis, and 6 of kerato-iritis. On the whole results are favorable although in a number of cases it is by no means certain that a cure would not have taken place as speedily without the tuberculin treatment. The results in treating cases of extrinsic tuberculosis are very encouraging but internal tuberculosis of the eye has not responded so favorably to tuberculin treatment except in the iris where the blood and lymph supply is good. With regard to dosage, it is necessary to give larger doses of vaccine in diseases of the eye than in treating disease elsewhere because the blood and lymph flow being limited, a less amount of opsonin will be brought in contact with the diseased area and also the risk of toxic effect is less as the area of infection is small.

Elsewhere in this paper the writer has stated that in all diseases of the eye due to pyogenic organisms it is advisable to use a specific vaccine from cultures of the infecting organism obtained from the patient to be treated, but this is generally

unnecessary in staphylococcus infection in which a mixed vaccine prepared from cultures of *staphylococcus aureus* and *albus* is usually efficient. In the internal infections of the eye the bacteriological diagnosis is difficult. However in cases of iridocyclitis, cultures may be made from the aqueous after paracentesis and the vaccines prepared from these have been used with excellent results.

CASE 1.—I. W. G., age 21, American, married, general health good except specific urethritis and gonorrhreal conjunctivitis. Came to me after treatment for two days by another oculist. Pus flow profuse, corneal ulceration both eyes. Evidently a specific infection had not been suspected as he was using a simple eye lotion. The eye was irrigated with 1-5000 bichloride solution; then with sterile water and nitrate of silver—a few drops of 1 per cent. solution—brushed over the everted lids; then a 25 per cent. solution argyrol was ordered applied by means of an eye bath every three hours, lids widely opened by the fingers in such a way as to fill the conjunctival sac. The next morning corneal ulceration worse and pus flow increased—discouraging. Sherman's No. 49 gonococcus and combined vaccine 0.5cc was given and as the therapeutic response was satisfactory, in fact remarkable, 1cc was given each day for six days and after this 1cc every fourth day for two weeks by which time the corneal ulcer has entirely healed. Now the local treatment first referred to was continued during the vaccine treatment, but the vaccines evidently influenced the favorable turn in the disease. The corneal scars are large and central but proper iridectomies will give fair vision.

CASE 2.—W. A. P., age 20, American, weight 104 pounds, poorly nourished, anæmic, came to me December 2, 1920. Had been treated for ten years at intervals by other oculists for diseases of the Meibomian glands and multiple recurrent chalazion and had never been entirely well at any time. I gave her at once staphylococcus combined vaccines, Sherman's No. 22, 0.5 mil. every third day alternated with 7½ gr. of cacodylate of sodium injections, extirpated the chalazions present and recovery was complete after one dozen injections of each and she has remained free from any disease of the lids until the present time.

CASE 3.—T. H. W., age 66, general health fair, family history good, had mature cataract both eyes. The post iritic adhesions in right eye made left seem more favorable for good operative results except that he had a pronounced

ectropion with severe blepharitis with a chronic discharge. Smears and cultures showed *staphylococcus aureus* and a few pneumococci. Two hundred million *staphylococci* and 100 million pneumococci in stock vaccine caused marked improvement in twenty-four hours. A few days later an autogenous vaccine with increased dosage was given and repeated every four days. In twenty days my patient had no discharge and the cataract operation was done on this eye with primary healing and a good visual result.

Before any operation for cataract where the conjunctiva is rich with bacteria, I give repeated preliminary injections of autogenous vaccines prepared from the flora of the patient's conjunctival sac. I have on two occasions treated wound infections after cataract operations with beginning hypopion, smears and cultures indicating the stock vaccine to use, until the autogenous vaccine was ready and in each instance the *staphylococcus aureus* and *albus* was the offender and perfect recovery followed vaccine treatment.

I have 11 cases selected from my case records for report but the time allowed me forces a collective review of them as follows: The practice was to administer an initial dose of mixed catarrhal vaccine when the patient was first seen, employing an autogenous vaccine where this was possible as soon as prepared, otherwise stock vaccine was used.

There were three cases of corneal ulceration, two due to the *staphylococcus* and one due to *pneumococcus*. Results as regards vision excellent except in the *pneumococcus* infected one in which the scar left made iridectomy necessary. There were three cases of perforating injury of the cornea with wound infection and hypopion. Two recovered, both due to *staphylococcus*; and in the one case due to the *pneumococcus* infection although the infection yielded the end result was not so good. There were two cases of ulcerative keratitis with hypopion both of which were cured as to infection but results optically in one not good. In the one cured vaccine with repeated paracentesis was done. One case of mucopurulent conjunctivitis of seven years' duration, due to *staphylococcus aureus* in which local treatment had failed, yielded promptly to the vaccine treatment. Two cases of gonorrhreal iritis diagnosed by exclusion; both improved after the first injection and recovered satisfactorily.

In all these cases improvement was noticed within twenty-four hours after the first inoculation. The minimum number of treatments in this group was five; the maximum number fifteen. The duration of treatment was from one to eight weeks. The injection was repeated from twelve to twenty-four hours to two or three days, the interval varying according to the indications.

Affections of the conjunctiva get well so readily by means of ordinary remedies, as a rule, that I have used vaccines for their cure rather infrequently, although I expect soon to try vaccines and serum therapy in trachoma and vernal conjunctivitis.

In conclusion I repeat that in an infection of the eye, acute or chronic, it is of great importance to act quickly before irremediable damage has been produced. To strengthen the vital resistance of all the tissues should be our aim. The elements of defense may be found in stock or autogenous vaccines or in the normal serum of animals, or, better still, in activated serum. I believe they are worthy of trial in all eye infections.

BIBLIOGRAPHY.

1. WRIGHT and DOUGLAS. "Proceedings of the Royal Society," vols. lxxii., lxxiii., lxxvii.
2. FLEXNER, SIMON, M.D. "Biologic Therapy," *Journal A. M. A.*, January 1, 1921.
3. WEAVER, GEORGE H., M.D. "Antistreptococcus Serum and Streptococcus Vaccines," *Journal A. M. A.*, January 1, 1921.
4. MAY, CHARLES H., M.D. "Vaccines and Sera," *Diseases of the Eye*, p. 406.
5. *Journal Am. Med. Assn.*, January 29, 1910.
6. *Annales de l'Institut Pasteur*, Nov. 9, 1911.
7. *Prac. Med. Series*, "Eye," p. 251, 1909.
8. *Ophthal. Klinik*, Nov. 5, 1908.
9. DERBY, GEORGE S. *Ophthalmology*, January, 1911.

A TENDON TUCKER AND METHOD OF SUTURING.

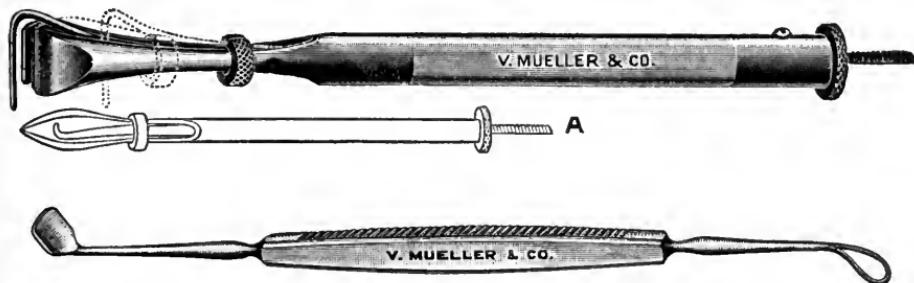
By DR. FRANK E. BURCH, MILLER HOSPITAL CLINIC,
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(With eight illustrations in the text.)

AFTER considerable experimenting and the construction of numerous models, to overcome the practical objections met with in experience with tuckers now in use, an instrument has finally been designed and tried out in a sufficient number of instances to recommend it to the profession. This instrument is light and easy of manipulation, designed to be used in a position at right angles to the tendon, thus affording a free field of operation. By its use, one secures a uniform shortening of any desired degree, and the tuck or fold in the tendon and muscle can be securely clamped at its base while the sutures are being placed in an exact and effective manner. It permits one, approximately at least, to measure the amount of shortening obtained. The likelihood of producing any change in the plane of rotation of the globe is minimized and the instrument can be immediately released without lateral traction on the tuck, thereby avoiding undesirable strain on the sutures.

The instrument is constructed with two parallel solid blades, between which a right angled tendon hook is raised by means of a milled nut at the top of the handle. The handle is made oval to facilitate easy manipulation, and the tendon hook is provided with a graduated scale at its upper end which approximately measures the number of degrees of shortening obtained. This scale does not follow the rule of one millimeter of shortening for each five degrees of correction, but is based upon clinical results following tucking operation, without

tenotomy, and with due consideration to the unavoidable muscle stretching which usually occurs.¹ The edges of the blades are slightly rounded to facilitate easy movement of the tendon over the blade end and to prevent undue tendon



stretching. A ring clamp slides over and secures the closed blades after obtaining the desired amount of tuck, and prevents any slipping of the tuck during suturing.

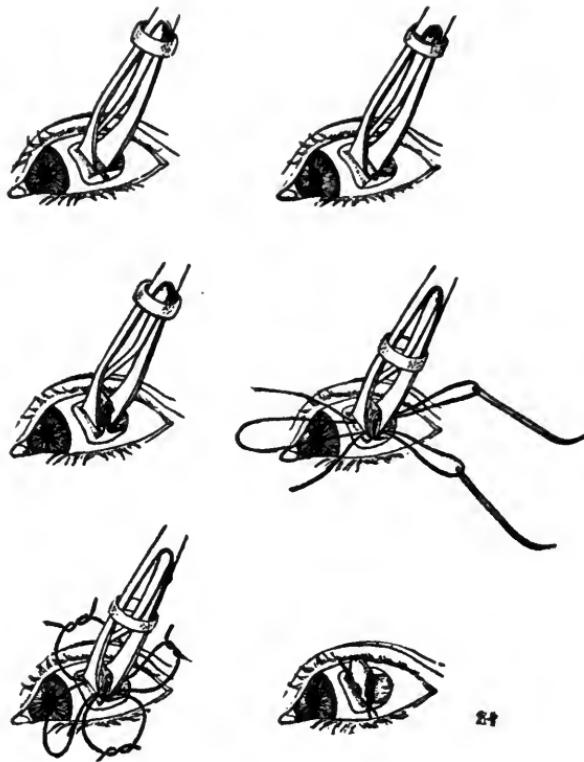
The technic employed is as follows.

After preliminary cocainization a subconjunctival injection of two or three minims of 2% cocaine adrenaline solution is made well back along the muscle sheath beneath the canthus. Through a liberal vertical conjunctival incision over the tendon insertion, the overlying conjunctiva is freed in all directions, the muscle fully exposed and its lateral borders defined with division of any scleral adhesions, exactly as done in preparation for the Reese resection, without, of course, cutting the tendon near its insertion. The hook of the instrument extended beyond the open blades, is inserted beneath the tendon from two to six millimeters from its scleral insertion, depending upon the amount of shortening to be obtained. Moistening the tips of the blades with glycerine materially eases the strain on the tendon in passing over the blade ends, and prevents, in some measure, undue stretching of the muscle. The milled ring at the top of the handle is rotated until the tendon is drawn up between the blades to the desired amount, the

¹ It will require a very considerable series of cases, observed over a long period, to determine the probable modification of this scale to render it more accurate. It is hoped that others may contribute their results to make it still more exact.

blades are clamped, and the ring clamp gently pressed downward until secure.

An important feature of any tucking operation is that sutures should be so placed that not only the central tendon



fibers but also the border fibers are equally sutured. The entire breadth of the tendon and muscle should be evenly sutured to prevent puckering, and sutures must hold for a sufficient time to insure complete permanent adhesions. The method found most effective and easily done, and which meets all necessary requirements, is as follows:

A 28-inch strand of "oo," 40 day catgut is double-threaded with half curved round needles one inch in length, each needle being placed about ten inches from the ends of the ligature. Each needle is then passed through the base of the tuck beneath the closed blades of the tucker from the corneal side, where the

middle and outer thirds of the tendon join. Any inclusion of conjunctiva is carefully avoided. The needles are drawn through and cut off, thus producing three sutures from one. The central and wing sutures are tied and double knotted. The ring clamp is released, a reverse turn of the milled nut given to slightly release the tendon hook, and the instrument is removed. The conjunctiva is closed with number one silk sutures.

In heterophoria and in squints of small amount, tenotomy, as a rule, has not been done until later. In higher degrees of divergent strabismus, division of the externus is advisable at the time. In practical use, it has been found that exophoria of six degrees was easily corrected by taking the least amount of tuck possible with the instrument. On the other hand, convergent strabismus of forty degrees was fully corrected by tucking as fully as possible, combined with tenotomy of the internus at the same sitting.

It has been found that the use of what I choose to term the Gifford "Splint" suture, a heavy silk suture passed completely beneath the opposing unoperated muscle and through each lid about four or five millimeters from its margin, is a most effective method of immobilizing the eye for from four to six days, and obviates the necessity of occlusion of both eyes to prevent ocular movement and undue strain on sutures. It has been repeatedly used and upon either lateral muscle without damage to the cornea in any instance. I regard it as a most valuable adjunct to any muscle shortening operation.

A thorough preliminary study of the muscle measurements and the dynamic forces involved, combined with a fairly considerable amount of actual experience and judgment, is required to satisfactorily correct every muscular defect. A certain amount of final readjustment of controlling innervating forces must occur after every operative correction, especially when good fusion exists, but it is surely easier of accomplishment, in my experience, after tucking operations than by any other method of operation. With the instrument described, used in conjunction with the method of suturing recommended, the tucking operation is much simplified, the parts are securely held in apposition during operation and during healing, the operative result is as nearly the end result as it is possible to

make it, and, in my hands, there have been no complications in healing. The fold or hump formed by tucking is only temporarily objectionable, and has never been sufficiently so to prove an argument against this procedure. However, it is well to inform the patient of this feature in advance of operation.

This instrument is manufactured by V. Mueller and Company of Chicago, to whom I am indebted for making the models for me.

EVISCERO-NEUROTOMY WITH AN ENDOTHESIS AS A SUBSTITUTE FOR ENUCLEATION.

BY DR. T. J. DIMITRY, NEW ORLEANS.

(With seven illustrations in the text.)

I HAVE expressed at times in different communications (2) a dissatisfaction with the results obtained following enucleation. I have also condemned the usual evisceration (3) as a substitute for enucleation because it leaves a dead space or a blood clot. Enucleation at times will serve its purpose but it is limited in its scope.

Like many of my confrères I have been ambitious for an operation which would correct faulty features noted following enucleation, evisceration, and substitutes. In this article I am submitting a new technic which I designate "Eviscero-neurotomy" with an endothesis.

ESSENTIALS.

The first consideration in estimating the value of any new operation is that it shall protect the other eye from a possible sympathetic ophthalmia, and the selected procedure should guard the other eye to the same extent as does enucleation. The second consideration is to obtain results which are most satisfying, surgically and aesthetically, for the patient and surgeon. The ideal operation reproduces the companion eye as to position, color, and motility. The first essential has been considered in a previous communication (3) while the latter is the theme of this paper.

THE BED.

So far without a single exception none of the substitutes have given full or general satisfaction as regards motility or position. I acknowledge that many of the substitutes provide a more natural bed for the prothesis, but the motility is usually not greater than is obtained after a carefully and well performed enucleation. It must be admitted, however, that this more natural bed results in better drainage and position for the lids, which is greatly to be desired and justifies to a limited extent many of the suggested operations.

THE MOTILITY.

Any technic which disturbs the conjunctival cul-de-sacs, reduces the radius of motility for the prothesis and is a faulty feature to be noted in practically all of the substitutes. The reason why the prothesis moves is not generally appreciated for many labor under the false impression that it becomes actually a part of the retained globe. This is not the case and the motility is dependent to a great extent upon the conjunctival cul-de-sacs themselves, pushing the prothesis with the globe, as the globe itself moves in different directions. Hence it is that we can explain both the movement and the limited excursion of the prothesis. If the prothesis was a very thin shell which covered only a little more than the cornea and not the cul-de-sacs a greater radius of motion would be obtainable. The prothesis is, however, a model of the conjunctival cul-de-sacs while it should be a model of the eye alone and limited to the bulb exclusive of the sacs.

ANÆSTHETIC.

The procedure is usually performed under local anæsthesia, for there is instillation of the selected anæsthetic which is usually a four per cent. solution of cocaine and, if necessary, infiltration of novocaine around the eye. General anæsthesia is used for children, rebellious patients, and when dealing with painful eyes.

THE INCISION.

The incision is seldom selected as it is governed by the condition demanding the operation, though the incision of choice would be in the sclera, concentric with the limbus four or five mm behind and about one fourth of the circumference of the

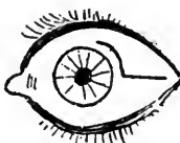


DIAGRAM 1.—Incision of election.

cornea. At either end this incision is continued backwards, tangential, either between the muscle fibers or between any two muscles. The length may extend to the optic nerve, though this is seldom necessary.

Evisceration.—The contents of the eye are then carefully eviscerated, and a gauze wrapped probe more readily removes the uveal tissue than does picking it with forceps. There is no

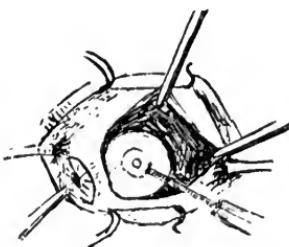
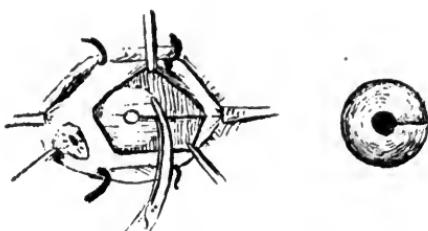


DIAGRAM 2.—Eviscerating and providing posterior window.

necessity of removing the endothelial layer from the posterior surface of the cornea, but it should be permitted to remain if possible.

Posterior Window.—This window is made very much as previously described (2) except that a knife is used instead of the knife and scissors. The nerve is severed with the knife. In making the window the incision which extends backwards to the nerve may be used to advantage. Through it the

nerve may be cut, a section of the sclera removed, and the window formed when suturing.



DIAGRAMS 3 and 4.—Another method of providing posterior window. The horizontal incision of No. 4 is carried to the optic nerve, the nerve is then severed with a small area of sclera. The window is formed when suturing. This is the better incision when it is desired to make a heterogeneous graft.

Suture.—The endothesis is inserted and the wound is closed by inserting sutures placed close together. Sharp cutting needles as also the use of the Fox's suture forceps prevents unnecessary trauma. The reaction following the operation is seldom severe and the sutures are removed in six to nine days.

COMMENTS.

Local anaesthesia is suggested advisedly and is thoroughly efficient for it is seldom necessary to resort to general anaesthesia except as previously noted. The operator simply eviscerates and the cornea is not removed. It is retained even though it is ruptured, for the wound in it may be enlarged and thus utilized. In such cases on completing the operation the cornea is sutured and here we may use to an advantage the little gold plates which have been recently suggested for suturing the cornea. If the globe is ruptured then the site of rupture is selected for the point of entrance.

ENDOTHEYSIS.

The sphere which is placed within the sclera is usually of glass or gold and about 14-17mm in diameter. It is neces-

sary to have a number of different globes for the ball should be neither too large nor to small. I desire to submit a prelimi-



DIAGRAM 5.—Endothesis in gold with enamel iris and pupil. The same can be blown in glass. Has button.

nary report on the endothesis which I am now developing and I would welcome your assistance in having it produced at a



DIAGRAM 6.—A different designed endothesis. Without button.

more reasonable price, giving an opportunity for more general use. The drawing depicts the endothesis, which is of gold and



DIAGRAM 7.—Section of the gold endothesis with enamel iris and pupil.

enamel, though I hope in the future to report its development in glass. The small button noted posteriorly is intended to fit in the posterior window without closing it. This button retains the endothesis in a proper position. At the opposite pole is the iris and pupil, the center of which is misplaced about fifteen degrees.

ORIGIN.

The operation which I have described embraces the suggestions of different authors. The evisceration feature of the

technic is credited to Barton (4) and Noyes (5) for they were the first to advocate the removal of the scleral contents. The severing of the optic nerve from the globe is credited to Boucheron (6) for he made such recommendations at the time that Deutchmann's theory held forth as to the mode of propagation of sympathetic ophthalmia. The posterior section of the sclera with the optic nerve attached is credited to Hall (7) and Huizinga (8). At least partial credit for retaining the cornea belongs to Gifford (9) and the incision in the sclera to Poulard (10). As in the Mule technic a ball is implanted. Even the title of my operation, "Eviscero-neurotomy" is an adoption from Huizinga.

The only features in the operation which are truly original are: the type of endothesis; the manner of preservation and the consequent advantages of the transparent cornea; and the development of a composite operation from a heterogeneous mass of suggestions.

RESULTS.

The hollow glass or gold ball produces a reflection which is seen through the transparent cornea. This wonderful advantage of transparency is lost sight of in the many substitute operations. Even if the cornea did not remain transparent as it actually does, at least it must be admitted that the corneal tissue does remain alive, though opaque. In this event, therefore, still tremendous advantage is obtained in that the prosthesis can be placed on a natural bed, which is ostensibly a whole eye. Furthermore, the cul-de-sacs are left undisturbed and a properly adjusted thin glass, fitting only the bulb and not the cul-de-sacs, will result in a most satisfactory range of motility.

It would be most gratifying to me if other investigators could be stimulated in an attempt to duplicate my experience in demonstrating the persistence of corneal transparency in spite of evisceration. My personal experience at present is too limited to be able to state that my observations will prove uniformly the same, yet working jointly with other investigators an irrefutable mass of material might be readily accumulated and result in exceedingly valuable information.

To obtain uniform maximum results all investigators should keep the same essentials in mind: (1) Retain the cornea. (2) Provide the posterior window. (3) Implant the spherical ball of plain glass, colored glass, or gold. (4) Note the changes that occur in the cornea. (5) Note the character of bed obtained for the prosthesis. (6) With these points kept in mind in preliminary observations, then insert in subsequent operations when it is generally procurable from the manufacturer, the Dimitry endothesis.

Should voluminous investigation along these lines corroborate my own limited experience, then we have obtained a result, procuring for the patient, for all intent and purposes, a duplicate functioning eye in every respect, ideal, except as to sight.

REFERENCES.

1. HUIZINGA. "Eviscero-Neurotomy," *J. A. M. Ass.*, Feb. 17, 1900.
2. DIMITRY, T. J. "An Operation Relegating Enucleation of the Eye to Its Proper Position," *A. J. Oph.*, vol. ii., Sept., 1919.
— "Injury of Sympathetic in Enucleation," *Oph. Record*, vol. xxvi., p. 183.
3. DIMITRY, T. J. "The Simple Evisceration and Enucleation of the Eye are Unsurgical Technics," *Southern Med. J.*, vol. x., July, 1917.
4. BARTON. "Recited" in *A. J. Oph.*, p. 572
5. NOYES. *Fourth Con. Oph.*, London, 1872.
6. BOUCHERON. *Gazette Méd.*, Paris, 1876, p. 27.
7. HALL. "Optico-Ciliary Neurotomy, *A. J. Surg.*, vol. viii., July, 1896, p. 96.
8. HUIZINGA. *J. A. M. Ass.*, Feb. 17, 1900.
9. GIFFORD. *Ophthalmoscope*, vol. xii., p. 18, 1914. ARCHIVES OPH., vol. xxxi., p. 10-20.
10. POULARD. "Conservative Operations," *Ann. d'Ocul.*, 155-233, 1918.

BIBLIOGRAPHY.

- JOHNSON, C. "Der plastische Ersatz der Nase und des Auges," *Beitr. z. Klin. Chir.*, Tübing., vol. cxvi., pp. 324-334, 1919.
- GIL, R. "Artificial Eyelids and Eye," *Semana Med.*, vol. xxvi., p. 837, Buenos Aires, Dec. 25, 1919.
- POTTS, HERBERT A. "Plastic Operation Restoring the Lower Eyelid, Making Insertion of Artificial Eye Possible," *S. Clin.*, Chicago, vol. iii., pp. 1165-1168, Oct., 1919.
- DE GOUVEA, H. "Ocular Prothesis," *Brazil Med.*, vol. xxxiii., p. 241, Aug. 2, 1919.

- VALOIS ET ROUVEIX. *Les Borgnes de la Guerre. Prothèse Chirurgicale et Plastique*, Masson et Cie, Paris, 1918, 227 pp.
- OMBREDANNE, L. "Autoplasties Faciales," *Bull. et mém. de la Soc. de Chirur. de Par.*, vol. xliv., pp. 592-605, 1918.
- GILLIES, H. DELF. "Discussion on Plastic Operations of the Eyelids," *Tr. Ophth. Soc. of the United Kingdom*, vol. xxxviii., pp. 70-99, London, 1918.
- LAGRANGE, FELIX. "De l'Anaplérose Orbitaire," *Bull. de l'Acad. de Méd.*, vol. lxxx., pp. 641-649, Dec. 24, 1918.
- SCHWENK, P. N. K., and POSEY, W. C. "Some Observations on the Restoration of the Orbital Socket," *Arch. OPHTH.*, vol. xlvi., pp. 576-586, Nov., 1918.
- ESSER, J. F. "Studies in Plastic Surgery of the Face," *Ann. Surg.*, vol. lxv., pp. 297-315, March, 1917.
- SOURDILLE. "Prothèse Oculaire chez les Blessés de Guerre," *Arch. d'ophthal.*, vol. xxxv., pp. 356-362, 1916.
- WOOD, CASEY A. *A System of Ophthalmic Operations*, Chicago, 1911, 2 vols. "Ocular Prothesis," vol. i., pp. 457 *et seq.*; "Surgical Treatment of Injuries to the Visual Apparatus," pp. 755 *et seq.*
- GROSSMANN, I. "A Contribution to Skin and Mucous-Grafting." Translated by J. A. Spaulding, *Arch. OPHTHAL.*, vol. xvii., pp. 299-306, New York, 1888.
- HANSELL, HOWARD F. "The Frost-Lang Operation," *N. Y. M. J.*, vol. iii., p. 943, May 29, 1920.
- SHOEMAKER, W. T. "Enucleation and Its Substitutes," *Penn. Med. Jour.*, vol. xxiii., p. 450, May, 1920.
- WEEKS, JOHN E., and GREENWOOD, ALLEN. "Enucleation of Eyeball and Its Substitute Operations," *Surg., Gyn. and Obstet.*, vol. xxx., pp. 410-411, April, 1920.
- GRIMSDALE and BREWERTON. "Enucleation and Its Substitutes," *A Text-Book of Ophthalmic Operations*. Second edition, Baillière, Tindall and Cox, London, 1920, pp. 178-225.
- GRIMSDALE, HAROLD. "Note on Early Case of Mules' Operation," *Brit. Jour. Ophth.*, vol. iii., p. 452, Oct., 1919.
- DIMITRY, T. J. "Operation Relegating Enucleation to Its Proper Position," *Am. Jour. Ophth.*, vol. ii., pp. 653-656, Sept., 1919.
- GOUGLEMAN, P. "Substitute Operations for Excision of Eyeball, from the standpoint of artificial eye maker," *Arch. OPHTH.*, vol. xlvi., pp. 268-272, May, 1919.
- HOWARD, HARVEY J. "Implantation of Glass Ball Within Tenon's Capsule by Verhoeff's Method," *Arch. OPHTH.*, vol. xlvi., p. 256-267, May, 1919.
- ALLING, A. N. "Fat Transplantation into Tenon's Capsule After Enucleation," *Arch. OPHTHAL.*, vol. xlvi., pp. 263-264, May, 1919.
- SWEET, WILLIAM M. "Implantation of a Metal Ball in Tenon's Capsule," *Arch. OPHTH.*, vol. xlvi., pp. 257-262, May, 1919.
- LAGRANGE, FELIX. "De l'Anaplérose Orbitaire," *Bull. de l'Acad. de Méd.*, vol. lxxx., pp. 641-649, Dec. 24, 1918.

- HALL, ERNEST A. "Enucleation of Eyeball," *Canadian Lancet*, vol. 1., pp. 299-300, Toronto, March, 1917.
- RAY, VICTOR. "A New Operation for Retention of a Movable Stump as a Substitute for Enucleation," *Ophthal. Rec.*, vol. xxv., pp. 187-190, Chicago, April, 1916.
- RE, FRANCESCO. "Esperimenti Anatomici in di un Nuovo Processo Operativo di Esenteratio," *Arch. di Ottal.*, vol. xxiii., pp. 335, 348, 1916.
- American Encyclopedia and Dictionary of Ophthalmology*, edited by Casey A. Wood, Chicago, pp. 4382-4475, 1915.
- LISTER, W. T. "Removal of Eyes in the Presence of Orbital Cellulitis," *Brit. Med. Jour.*, vol. i., pp. 418, London, March 6, 1915.
- MCNAB, ANGUS. "An Operation for the Excision of the Conjunctival Sac and Lid Margins," *Tr. Ophth. Soc. United Kingdom*, vol. xxxiii., pp. 50-55, London, 1913.
- ALLPORT, FRANK. "Operations for Enucleation of the Eye and Their Substitutes," in *A System of Ophthalmic Operations*, edited by Casey A. Wood, Chicago, 1911, vol. i., pp. 539-642.
- FOX, L. WEBSTER. "The Present Status of Mules' Operation and of Delayed Implantation of a Gold Ball," *Ophthalmoscope*, vol. vii., pp. 6-12, London, 1909.
- BARRAQUER. *Internat. Med. Cong.*, Madrid, 1903. ("Modification of Mules' Operation in which Mass of Fat is Inserted Instead of Glass Ball.") (Ref. to by Weeks and Greenwood, *Surg., Gyn. and Obst.*, vol. xxx., p. 410, 1920.)
- HERTEL, E. "Ueber Paraffinprothesen in der Orbita," *Arch. f. Ophthal.*, vol. lv., 239-255, 1902.
- GOLOVINE, S. S. "Procédé de Cloture Plastique de l'Orbite Après l'Ex-entération," *Arch. d'Oph.*, Par., vol. xviii., pp. 679-684, 1898.
- HAINES, H. "Evisceration of the Eyeball with Introduction of Artificial Vitreous or Mules' Operation," *New Zealand Med. Jour.*, vol. ii., pp. 5-11, Dunedin, 1888-9.
- MULES, P. H. "Evisceration of the Globe with Artificial Vitreous," *Tr. Ophthal. Soc. United Kingdom*, vol. v., pp. 200-206, London, 1885.
- CARLOTTI and BAILLEUL. *Annal. d'Oculist.*, vol. clii, p. 104, Paris, 1914.

CAUSES OF BLINDNESS AMONG FILIPINOS AS
OBSERVED IN THE PHILLIPPINE GENERAL
HOSPITAL DISPENSARY—A PRELIMINARY RE-
PORT.

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IN our efforts as physicians to teach the masses to observe the important rules of hygiene for safeguarding the public health from epidemics, we should not for a moment forget to inculcate also in their minds the need of taking good care of this very delicate organ—the eye. Each one of us is cognizant of the sad fact that many cases of permanent blindness among our laity could have been prevented had the proper care and treatment been early instituted. We also know that a blind person is an economical loss to the country.

But before we proceed to start a campaign for preventing blindness, we should first determine its most common causes. The Philippine General Hospital Dispensary, where one meets thousands of eye cases, offers the best place at present for an investigation of this nature.

Now, having these materials and the facilities for diagnosis, the next thing we have to think of is an arbitrary definition of blindness. Blindness, in the strict sense of the word, is the inability to distinguish light from darkness. But this definition is too exclusive. There are many who can perceive light and yet are too blind to do the ordinary activities of life. According to the last annual report of the Bureau of Health there are about 4276 blind in the Philippine Islands. I am

quite sure that this number will be greater if we do not use the strict meaning of blindness. Our country is rapidly progressing along social lines. In the near future we will see social workers organizing themselves to look after the education, employment, and maintenance of these unfortunate blind. Hence, we need to have more or less accurate number of our blind countrymen. And to accomplish this I would suggest to future investigators to adopt a uniform definition of blindness. Bishop Harman (1) in his criticism of the British Census of 1911 very truly said that many partially blind or blind for all practical purposes were never enumerated at all so that the results were very misleading. In this preliminary investigation, I have followed the definition of blindness adopted at the Egyptian Ophthalmic Hospitals, namely, "inability to count fingers held up at a distance of one meter from the patient." This is simple and very practical.

These statistical tables are based upon 700 cases of blindness in one or both eyes examined during the years 1920 and 1921.

TABLE I.

Congenital blindness.....	6
Acquired " 	694

TABLE II.

Blind in one eye.....	440
Blind in both eyes.....	260

TABLE III.

Children (1-13 years inclusive).....	123
Adults (14-60 ").....	461
Old (61-up).....	116

TABLE IV.

Number of eye patients during the years 1920 and 1921	5,604
Number of patients blind in one or both eyes.....	700

TABLE V. *Causes of Blindness:*

Cataract.....	187
Injury with subsequent infection.....	173
Glaucoma.....	64
Complication of some fevers.....	37
Keratomalacia.....	31
Syphilitic infection.....	13
Gonorrhreal infection.....	12
Trachoma.....	8

Scleritis (deep form).....	6
New growths.....	4
Tuberculosis conjunctiva.....	2
Hysterical blindness.....	1
Microphthalmus.....	5
With obscure history and origin.....	161

DISCUSSION.

Table I. We have observed 2 cases of congenital cataract, 1 case of microphthalmus, 3 of "prenatal corneal scarring."

Tables II, III, IV are self-explanatory.

Table V. Causes of Blindness:

Cataract.—There were observed 170 cases of senile, 15 of juvenile, and 2 of congenital. Traumatic cataract is included under *Injury*.

Injury with Subsequent Infection.—These injuries have caused the following eye affections: Corneal ulcerations, 60; Leucoma, 28; Traumatic cataract, 27; Panophthalmitis, 15; Phthisis bulbi, 13; Staphyloma, 10; Iridocyclitis, 2; Rupture of the eye from gun shot, 1; Rupture of the eyeball from other trauma, 2.

We have 15 cases of blindness as complication of dacryocystitis. I wish to emphasize here the fact that a great majority of corneal ulcerations as those produced by foreign bodies would not have caused this disastrous result—permanent blindness—had not the eyes been subjected to further trauma and the subsequent infection caused by "kahig." ("Kahig" is the procedure employed by the laity to remove foreign bodies in the eye usually by means of the tender end of the stalk of a certain grass, without the least aseptic precaution.)

Glaucoma.—The majority of cases have history of acute symptoms and vision is rapidly annihilated.

Complications of Some Fevers.—We have 23 cases of blindness as complication of variola. I am convinced that this number is much less than what we would find were we to look for this kind of blindness in the provinces, for the reason that the totally blind do not often seek relief. They or their friends are convinced of the hopeless nature of the calamity which has befallen them and they do not come to the clinic. We have observed 6 cases as complication of measles, and 8 of other fevers.

Keratomalacia.—This is observed among children of poor families. They are very poorly nourished and with history of protracted ileocolitis or tuberculous pneumonia.

Venereal Disease.—Our cases of purulent conjunctivitis would have been much more were it not for the effective campaign of the Bureau of Health, the Public Welfare Commission, and the Philippine General Hospital. We ought to feel proud when we hear that in Mexico (2) the most common cause of blindness is ophthalmia neonatorum. In round numbers it is 30%. In British Blind Schools (3), ophthalmia neonatorum is the cause of at least $\frac{1}{3}$ of the blindness, and it accounts for upwards of 10% of all cases in England.

With the increase of cases of syphilis, blindness from this disease is gradually increasing.

Trachoma.—Blindness from this disease is apparently uncommon. For the sake of comparison, we can mention that 25% of all the cases of incurable blindness in Russia are due to trachoma (4).

New Growths.—We had 2 cases of glioma retinæ, 1 of epithelioma, and 1 of papilloma of the choroid.

Tuberculosis.—Since tuberculosis is the most prevalent disease here, we should be on the lookout for the ocular involvement of this disease. We had 2 cases of tuberculosis of the conjunctiva.

Blindness with Obscure History and Origin.—We cannot get good history from these cases. Patients cannot trace the origin of the trouble. Oftentimes, they attribute the inflammation of the eye and the subsequent blindness to sleeping with the hair wet. These cases are grouped under the following affections: Leucomas, 34; Plastic iritis, 29; Corneal ulcerations, 27; Keratitis, non-suppurative, 18; Shrunken eyeball, 17; Panophthalmitis, 9; Optic atrophy, 9; Optic neuritis, 2; Iridochoroiditis, 1; Staphyloma corneæ, 8; Staphyloma scleræ, 1; Keratoconus, 4; Retinal hemorrhage, 1; Amaurosis, undetermined, 1.

CONCLUSION.

We cannot make as yet any definite conclusion. An investigation of this nature should be made for several years,

and extended throughout the whole archipelago. We as medical men should take it as a duty to our country to study the causes of blindness and to formulate and recommend suitable measures for its prevention.

BIBLIOGRAPHY.

1. *Report of the Proceedings of the Section on Ophthalmology of the British Medical Association*, July, 1911.
2. RAMOS, DR. J. *Anales de Oftalmología*, May, 1915.
3. *Ophthalmic Review*, Sept., 1909.
4. BOCKOWSKY. *Klin. Monatsbl. f. Augenheilkunde*, Sept., 1908.

A REPORT OF THREE CASES OF TUBERCULOSIS OF THE CONJUNCTIVA.¹

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UP to the present time, I do not know of any record of ocular tuberculosis that has been published in these Islands. There is no doubt that tuberculosis of the eye, especially that of the conjunctiva, is rather a rare affection but nevertheless it is hard to believe that it does not altogether occur among our people, as it appears to be, especially if we take into consideration how prevalent the pulmonary form of the disease is here and how very poorly the people observe preventive measures for its spread. In order to correct, in a way, this erroneous impression I took up the report of these three cases that came to our observation since 1920. During the years 1920 and 1921, there were treated in the dispensary of the Philippine General Hospital 5,604 eye cases, only 2 of which were found to be tuberculosis of the conjunctiva. Case 3 in this report came to the hospital only on January 1st of this year.

CASE 1.—A female child, 8 years of age, was admitted to the surgical department of the Philippine General Hospital because of enlarged suppurating lymphatic glands in the neck and preauricular region of the right side, and with ulcerations in the right eye. The ocular trouble was referred to our department for diagnosis and treatment. The eye lesion was said to have been one year before her admis-

¹ Read before the Fifth Medico-Pharmaceutical Congress of the Philippine Islands, 1922, Section on Ophthalmology and Oto-Rhinolaryngology.

sion to the hospital after some foreign body (dust particle) has entered the eye. The patient did not complain of much pain from the eye but rather came to the hospital because of the lesion in the neck. The suppuration of the cervical lymphatic glands was of six months' duration. The family history was negative for tuberculosis. Upon examination of the right eye there was found extensive infiltrated and ulcerated area on both the bulbar and palpebral conjunctiva. The lesions involved also the cornea. The surface of the ulcers was covered with yellowish muco-purulent discharge which on being wiped out presented a base in the form of unhealthy granulation tissue. In view of the great extent of the lesion in the eye the only advice that could be given at that time was enucleation of the eyeball. In this case the extensive ulceration of the eye together with the glandular involvement of the neck and preauricular region did not offer great difficulty in making the diagnosis. X-ray examination of the lungs showed enlarged peribronchial glands. The eye was enucleated and it was surprising to notice how the adenitis gradually subsided and the patient was discharged with a good healed up stump in the right eye socket and healed up scars in the neck two and a half months after the operation. On December 13, 1921, this child came back with inflammation of the inner canthus of the right eye and a lacrimal fistula discharging thin purulent secretion. This appears to be an extension of the former eye affection. Only medical treatment was instituted in the form of an eye wash and instillation of silver nitrate solution 2%.

CASE 2.—A young man, 19 years old, was admitted to the hospital June 14, 1920, because of redness and lacrimation of the right eye of three years' duration. The patient stated that his eye trouble started after the entrance of a foreign body in that eye. He first felt pain in the upper lid, later on there was redness and lacrimation and then pain also in the lower lid. On examination the bulbar conjunctiva was congested and on evertting the lids (which was done with great difficulty) there was found ulceration and hypertrophied granulation in the fornices of both lids. There was also a small amount of muco-purulent discharge in the conjunctival sac. The cornea was apparently normal. The vision not impaired. Left eye was normal. This individual was strong, well developed, and well nourished, with negative findings in the lungs upon auscultation and percussion. X-ray showed dense shadow at the hilus. The cervical lymphatic glands were not enlarged. Von Pirquet reaction was negative. The ulcers of the conjunctiva were cauter-

rized with copper sulphate stick, but very little improvement was obtained. No other examination could be made on this patient nor other treatment given because he insisted on going home to the province. About a year later (July 26, 1921) this same patient was again admitted, this time with a very advanced eye lesion. The lids were puffy and there was a sort of pannus covering the cornea. The ulceration has extended over the whole bulbar conjunctiva. The ulcerated area had the appearance of granulation tissue. There was profuse lacrimation and the patient was complaining of much pain. The left eye, however, was apparently unaffected.

The appearance of the eye lesion and its slow progress were suggestive of a tuberculous process. Smear from the discharge from the eye was negative for acid fast bacilli. Section from the ulcerated bulbar conjunctiva was histologically examined and was reported to be tuberculosis. Deep X-ray therapy was given three times, later on thermocautery was employed, but both forms of treatment gave unsatisfactory results. As the lesion in the eye was already very extensive and the patient was suffering from much pain and headache enucleation was proposed to which the patient readily consented. The stump healed after one month but the discharge continued. He was then treated in the dispensary where he was advised to expose the stump of that enucleated eye to direct sunlight for from 2 to 5 minutes daily. The discharge apparently diminished and the patient said he felt better. Constitutional treatment in the form of tonics has been given.

CASE 3.—Patient was admitted only last January 1st. The patient was a woman 32 years old who came with extensive ulceration of the palpebral and tarsal conjunctiva of the right eye, corneal involvement and loss of vision in the same eye. In the lids of the left eye there was hypertrophy of the tarsal conjunctiva with cicatricial changes at the margins, those in the lower lid giving rise to slight entropion, and as a result of which a small ulcer was produced at the lower portion of the cornea due to the constant rubbing of the turned in cilia. The discharge was abundant, yellowish, muco-purulent. The lids of the right eye were very much thickened and infiltrated. Vision was negative in this eye. The ulcerations in the right eye were of three months' standing. Examination of the lungs revealed some impairment of resonance at the apices. X-ray showed scattered shadows in the lung field specially in the left apex suggestive of t. b. in the words of the roentgenologist. Smears from the conjunctival sac were negative for acid fast bacilli. Section from the bulbar portion of the ulcerated

conjunctiva showed the lesion to be tuberculous in nature. The patient refused surgical treatment. Instillation of silver nitrate 2% sol. was given, and as not much improvement was observed heliotherapy was tried. The right eye with lids everted was exposed to direct sunlight for 5 minutes twice daily. Six days after there was noticed a marked diminution of the secretion and the hypertrophied granulation appeared more flattened. The patient insisted in going home before this treatment was over.

Tuberculosis of the conjunctiva occurs in a variety of form and according to Eyre 5 types have been described: (1) The ulcerative form. (2) Miliary tubercle. (3) Hypertrophic granulation. (4) Lupus. (5) Pedunculated tumor. All of our cases appear to be of the ulcerative type, although the bases of the ulcer resemble granulation tissue. This variety of manifestation of the disease when affecting the conjunctiva, may account in part for the apparent rarity of these cases as some may have probably been overlooked or confused with other affections.

CONCLUSIONS.

It is evident that from the number of cases here represented no conclusion can be drawn as to age, or sex incidence, but all three cases occurred in patients under 35 years of age.

As to diagnosis, the smears from the eye discharge have always failed to show the tubercle bacilli, and the only conclusive means of diagnosis in two of our cases has been the histological examination of section from the lesion.

In the two cases where heliotherapy had been employed we obtained some indications of improvement. However, I abstain from giving any conclusive opinion as to the value of sunlight in the treatment of these cases as my experience in it is yet very meager. George Libby of Denver reported good results from heliotherapy in combination with tuberculin injection, and he cited the case of a medical student in Switzerland whose eye has been infected with tubercle bacilli in opening an abscess, where complete cure took place by exposure to direct sunlight only without the use of tuberculin.

In all three cases the right eye was the only one involved

although in Case 3 some cicatricial changes have been found in the lids of the left eye.

The ocular lesions in these cases appear to be secondary inasmuch as certain signs of lung involvement have been found in them, although in Case 2 these were very doubtful as only density at the region of the hilus was discovered by X-ray examination.

INTRAOOCULAR FOREIGN BODY.¹

BY DR. L. D. BROSE, EVANSVILLE, IND.

THE prognosis in eye injury, the result of intraocular foreign body, depends upon the nature of the foreign body, the eye structures injured, the seat of lodgment of the body, and the degree of infection it carries. Lead, especially the smaller shot, may enter the anterior part of the eye, pass through the eye chambers, reperforate the eye, and come to lodgment in the orbital tissues with the preservation of fair vision. I have met with such cases. However, a shot coming to arrest in the vitreous chamber is not well tolerated and it is my experience that such eyes must sooner or later be enucleated. The lens, on the other hand, tolerates most foreign bodies well, although it readily becomes cataractous. Particles of glass and stone are likewise at times well tolerated through becoming encysted. Copper, when it is arrested intraocularly outside of the lens, is badly tolerated and a particle of aseptic copper, if permitted to remain in the iris, ciliary body, or vitreous, sooner or later, because of chemical changes which take place, gives rise to pus formation. I recall a particularly sad case of intraocular injury through copper and glass, that of a five-year-old boy who pounded a cartridge in a glass vessel causing it to explode with the result that numerous particles of copper and glass perforated the cornea. I advised enucleation of the eye but the father objected, saying I had treated an eye injury in the son of a prosperous near neighbor and did not remove the eye and now because he was a poor man I wished to take his son's eye out. Notwith-

¹ Read before the First Indiana Councilor District Medical Society, May 9, 1922.

standing my explaining the difference in the nature of the two injuries and warning him of the danger of the good eye becoming diseased through sympathy he remained obdurate with the result that the boy became incurably blind in both eyes within twelve months. The introduction of the radiogram and the improved large magnet have been of the greatest help to the oculist, both in diagnosis and treatment of these injuries. I have recently had an interesting example of copper in the posterior aqueous chamber, where a radiogram was of great service.

The patient, a boy twelve years of age and living at Birdseye, Ind., on Sept. 1, 1921, exploded a dynamite cap lacerating the left hand and injuring the left eye. I saw him on Sept. 25th and a careful examination established the following. In the upper and outer corneal quadrant a lacerated wound with which the iris was adherent causing an irregular pupil. The lens was partially cataractous and vision reduced to the counting of fingers directly in front of eye. He was admitted to the Walker Hospital where a radiogram by Dr. Baker verified the diagnosis of foreign body and localized it 3mm above a horizontal plane of the cornea, 5mm to temporal side of vertical plane and 6mm back of corneal center. Under general anaesthesia the anterior chamber was opened with the keratome at the indicated point, an iris forceps inserted through the lacerated iris wound into the posterior aqueous chamber, and at our second attempt the forceps was felt in contact with the foreign body and we successfully removed the particle of copper. The eye healed kindly and the lens is gradually being absorbed so that when last seen on Nov. 13, 1921, he counted fingers at six feet.

In the following case the X-ray and the magnet were in turn serviceable.

Myrtle H., *aet* 10 years and residing at Winslow, Indiana, was brought to me by her father on January 16, 1919. She had been pounding with a steel hammer when the left eye was injured some three weeks ago. I found a small grayish opacity in the cornea to the outer side of the pupil, a cataractous lens, and vision reduced to good light projection. A radiogram confirmed our diagnosis of intraocular foreign body. On January 25th, after rendering the cornea anaesthetic with $1\frac{1}{2}\%$ solution of holocaine and with

the assistance of Dr. M. Ravdin, the eye was brought in contact with the giant magnet and in a few seconds the particle of steel came forward into the anterior chamber from whence it was removed by the small magnet through an opening made at the corneal periphery. The eye healed rapidly and vision is again restorable with removal of the traumatic cataract.

The radiogram may fail to establish the presence of an intraocular foreign body, either because the body is a very small one or the picture taken is faulty. The large magnet may, nevertheless, be successfully used as was done in the following patient:

Claude O. Flynn, æt. 60 years, and residing at Owensboro, Ky., was sent to me on May 30th, by Dr. J. H. Thorpe. He injured the right eye while using a hatchet, experiencing sudden pain and loss of sight. Focal examination revealed a faint grayish corneal opacity in the upper corneal quadrant; a small underlying iris injury with posterior synechia and a cataractous lens. Notwithstanding an X-ray picture was negative, we still held to our diagnosis of intraocular foreign body. The eye was rendered non-sensative by holocaine and brought in contact with the giant magnet, Dr. M. Ravdin assisting. At the third attempt the particle of steel came forward into the anterior chamber from whence it was recovered by the hand magnet through an opening made in the corneal periphery. The iris, which appeared in the wound, was reposited, the eye bandaged, eserin instilled, and the patient requested to enter a hospital and remain in the city a few days. Instead, he returned to his home and Dr. Thorpe wrote me some six weeks later that the eye healed without complication and that vision can be restored with removal of the cataractous lens. The steel recovered was scant 1mm in length and less than that in width.

It is possible to make a diagnosis of intraocular foreign body without the aid of the X-ray, without the help of the magnet, and without a history of eye injury as was done in the following patient.

Mr. W. C. B., æt. 28 years, and residing at Mounts, Ind., consulted me on June 12, 1897, for a badly inflamed and painful right eye. He had been under treatment by an oculist for eye inflammation and at the end of two weeks

the oculist leaving the city for a vacation directed him to return to his home and continue the use of atropin. The pain becoming unbearable he at once returned to the city and thus came into my hands. I found an intense iridocyclitis, the iris discolored, the aqueous turbid, pupil contracted, and a small hypopyon. Vision was reduced to good light projection except in the upper anterior retinal region. He could give no reason for the inflamed eye. Upon careful focal illumination I detected in the upper outer mid-corneal quadrant a very faint grayish line-like opacity and gave the diagnosis of intraocular foreign body. With this, the patient recalled that a day or two previous to the eye inflaming he had handled iron hoops and after pounding upon one with a hammer he suddenly experienced momentary sharp pain but continued at his work and forgot about it. I advised that the eye be enucleated, to which he consented. The removed eye was sectioned and a particle of rusty iron found in the posterior aqueous chamber embedded in pus. Recovery was uninterrupted and he has remained a very grateful patient.

In the diagnosis of intraocular foreign body we consider the history of the patient, examine the cornea and sclera for entrance wound, note whether the pupil is regular or not in contour, if the iris is injured, whether the lens is cloudy or not, and follow this if the intraocular media permit by careful ophthalmoscopic fundus examination. The retina and choroid may disclose rupture, hemorrhage, detachment, and later pigment changes. A foreign body in the fundus embedded in blood extravasate and fibrin may be mistaken for an inflammatory exudate. Particles of iron and steel after a time give rise to other evidence termed siderosis bulbi. This we recognize through gradual rust discoloration of the tissues, occasioned by partial solution of the iron by the intraocular fluids and its diffusion and redeposition, the iris taking on a brown or greenish-brown hue, the lens capsule staining with brown ring-like discoloration. With this the retinal function is impaired and the patient complains of night blindness and discloses circular contraction of the field of vision. Hematogenous siderosis, a staining of tissues with iron containing pigments derived from the blood, must not be confounded with siderosis bulbi due to intraocular foreign body. An eyelash carried into the anterior chamber may give rise to iris cyst or carry

serious infection, the reaction following intraocular injury may result from infection carried into the eye by the foreign body or may follow a later introduction through tardy closure of the entrance wound or through infection due to prolapsed iris. A moderate degree of infection does not always mean loss of the eye. Vitreous abscess most certainly does. Hence, in our treatment we make sure not to use unclean instruments nor contaminated dressings. Where iris prolapse is recent and non-adherent, an attempt may be made to reposit it. Otherwise, not only prolapsed iris but other ragged tissue presenting in the wound should be cut off. Gaping wounds in the cornea or in the sclera may be covered with conjunctiva. The injured eye should be bandaged and the patient confined to bed. The earlier the foreign body is removed from the eye interior the better the chances for retaining the eye. It is not always best to remove a magnetizable body by the anterior route with the large magnet. On the contrary, if the lens is found fairly clear and the foreign body shown to be of some size, a puncture posteriorly through the sclera is safer and readily permits of extraction of metal with the small magnet. The dragging of a large particle of steel with ragged edges through the lens, ciliary body and iris by the anterior route may so injure the eye as to destroy its usefulness and call for enucleation. Our immediate result may be apparent preservation of the eyeball and later because of repeated recurrence of intraocular inflammation we may find it necessary to remove the eye. I have had such experience in a boy who met with a perforating eye injury through a bird-shot striking the inner orbital wall and being so deflected that the globe was perforated near the equator and the shot ranged forward through the lens and iris into the anterior chamber from whence it was recovered with forceps through a peripheral corneal opening. The eye apparently healed with some sight preservation but fifteen years later I was called upon to enucleate it. With the passing of time intraocular cicatricial changes followed, the retina became detached, the eye disorganized, and lastly irido-cyclitis set up.

OCULAR PEMPHIGUS.

BY DR. LLOYD B. WHITHAM, BALTIMORE, MD.

PEMPHIGUS is a term of diverse clinical application: there being, firstly, the fulminating disease, acute malignant pemphigus, which occurs, usually, in those who handle decomposing carcasses, and is characterized by high fever and other symptoms, notably bullæ on the skin, mucous membranes, and conjunctiva, death, in 75% of cases, ensuing within a fortnight, due to the severity of the general infection.

Next, and oftenest confused with true pemphigus, is the more frequently seen Duhring's disease or dermatitis herpetiformis, offering a variety of pictures but definitely differentiated by its polymorphic eruption, accompanied by itching and pain, its tendency to recurrence, the fact that the patient's health remains good throughout, and, lastly, by the eosinophilia more recently emphasized.

Thirdly, there is a group of minor pemphigoid states, not at all resembling the genuine condition and, lastly, an exceedingly rare affection, pemphigus vulgaris or chronic pemphigus, by which is meant a slowly progressive and frequently fatal disease, marked by a dermatitis with successive crops of bullæ appearing upon apparently normal skin, as well as by analogous manifestations on the mucous membranes, accompanied by varied constitutional symptoms, and lasting for an indefinite period.

Pemphigus conjunctivæ has been recognized as a clinical entity for 63 years, though confused with xerosis and otherwise designated as "syndesmitis degenerativa" and "essential shrinking of the conjunctiva," respectively, causing considerable controversy until von Graefe identified the latter process

as merely a stage of pemphigus of the eye, since which many other observers have concurred in this conception.

Were not the rarity of the condition attested by the dearth of reported cases in the literature, the following table, alone, would suffice to establish the fact:—

In 200 cases of pemphigus of the skin and mucous membranes Hebra was unable to find one with ocular involvement, while Pergens's 132 collected cases showed blebs on the conjunctiva in 1.5% with essential shrinking in 12%. In 45,000 patients with ophthalmic affections Franke found 5 of ocular pemphigus, in 22,000 Pergens detected 2, among 70,000 cases Horner ran across 3, Santos Fernandos had the same number in 50,000, while Posey saw but one in a series of 75,000.

Fuchs gives a very excellent and vivid picture of this ocular disease, with which the case to be cited tallied rather closely, except that bullæ were readily and frequently observed and were larger than the small vesicles to which he refers in his book. The pathology and bacteriology are accurately described by Parsons:—

"The bullæ do not involve the whole thickness of the conjunctiva. The fluid contents are at first clear serum; later they invariably become cloudy and contain fatty-degenerated epithelial cells, leucocytes, a few red corpuscles, granular debris, and coagulum. Changes occur in the cornea which is gradually transformed into vascular scar tissue, covered by thickened, papillary, horny epithelium.

"The bacteriology of the skin (as well as that of the blebs upon the conjunctiva) has led to discordant results, and the condition is now regarded as due to the action of toxins upon the nerve centers."

Treatment, aside from the palliative, symptomatic form, has been generally unavailing. Numerous writers have made interesting and original suggestions and Wood, of Cape Town, claims success from saline irrigations with closure of the eyes, and follows the subsidence of the acute manifestations by conjunctival implants, while Gewalt and, later, Brenning, have reported curative results following turpentine injections.

Aside from the instance to be reported, the writer has seen two cases of supposed ocular pemphigus presenting the characteristic picture of phthisis conjunctivæ with hard,

opaque, scaling corneæ, binocular, which were presumed to represent late pemphigus conjunctivæ and so diagnosed in the dispensary records, and one of sub-acute pemphigus of the pharynx with essential shrinking of the conjunctiva of both eyes. The vagueness of history, the fact that the onset is often so insidious that subjects fail to apply for expert treatment until decided secondary changes have supplanted the acute phase, and the inability to definitely rule out other factors in advanced cases render such diagnoses tentative and unsatisfactory.

In July, 1917, a definitely proven ocular pemphigus, in its early stage, came under the author's observation, and, while it has, already, been touched upon in his review of the work of the advanced eye center of the American Expeditionary Forces in France, it was not deemed wise to report it until sufficient time had elapsed for corroboration by other unbiased ophthalmologists. Now, however, the case has been followed for over four years, and the diagnosis confirmed.

Private C. E. was first seen on July 31, 1917, at the Johns Hopkins Hospital Unit, Bazoilles-sur-Meuse, France.

History.—Patient complains of a sore and inflamed left eye. This eye has been a source of annoyance during the past five years; there have been periods of severe pain and inflammation, with intervals of apparent normality and freedom from any subjective or objective symptoms of disease, except that the vision has gradually failed in both eyes, though to a more noticeable degree in the left, and he remarks that it is this eye which has been, on past occasions, considerably traumatized from one cause or another. Patient had five attacks of gonorrhœal urethritis. Denies syphilis. Father and an uncle each lost an eye from causes unknown.

Present Condition—Physical examination: Thorax and abdomen negative; genitalia,—scars of numerous chancroids upon glans penis; extremities,—some scars over right tibia; reflexes,—generally increased, especially the patellar.

Left Eye.—Marked swelling of the lids, blepharospasm and photophobia, with profuse lacrymal discharge, as well as considerable muco-purulent, conjunctival secretion. There is a decided blepharitis marginalis sicca with a few small hordeoli. The palpebral conjunctiva is exceedingly engorged and swollen, the surface being red and beefy in appearance, though moist and fairly smooth. The bulbar

conjunctiva is extremely congested but not unduly chemotic. There is a large, superficial ulceration of the bulbar conjunctiva, fairly circular in outline and about 5mm in diameter, immediately infero-nasal to the cornea and in juxtaposition to the limbus. The ulcer appears to extend into the cornea for about 1mm beyond the margin, and there is a grayish-yellow infiltration, which, apparently, extends into the substantia propria, and mars the transparency. There are two small ulcers in the bulbar conjunctiva near the inferior fornix.

Treatment.—Atropine and other local remedial measures as indicated.

At this time three aetiological factors presented themselves: gonorrhœa, lues, and some rare leptothrix or fungoid infection, and, in fact, the earlier smears seemed to support the latter view.

Repeated smears and cultures were negative for any definite bacterium. Lues was partially ruled out by a negative Wassermann.

Various modifications of and actual changes in the local and systemic treatment were tried, but the condition proved most refractory to all, still more definitely ruling out lues.

August 4, 1917. Smear from ulcer failed to reveal anything definite; there were many polymorphonuclear leucocytes, a few epithelial cells, much fibrin, a few cocci, bacilli of a nondescript variety, and something that was suggestive of a streptothrix.

Urinalysis and blood tests negative.

August 26 and 27, 1917. Negative for all higher bacteria or fungi, for the gonococcus, and for the tubercle bacillus.

August 28, 1917. There is still considerable blepharospasm and local irritation. The two ulcers remarked at the inferior conjunctival fornix have practically healed. In addition to the main ulcer, noted upon the first examination, there is a small, incipient, superficial ulceration about 5mm supero-nasal to the cornea. Smear from this fresh ulcer negative.

September 1 and 2, 1917. More corneal ulcers noted, from which five new smears were made. Negative.

September 4, 1917. Examiner first impressed with the possibility of a pemphigoid affection because of observing the small remnant of a veil-like film still attached to the edge of a very new ulcer and which might represent the erstwhile covering of a broken bulla.

September 5, 1917. Dermatologist (Dr. Wile, of the University of Michigan) called in consultation, the following note being given by him: "General examination of the patient and a careful consideration of the history brings to

light a doubtful infection, possibly mixed, in 1909, not followed, however, by any recognizable secondary lesions. On the glans penis are numerous shallow scars, the result of previous ulcerative lesions, and over the right tibial region there are a few, small, punched-out scars, the result of some circumscribed ulcerative process. The absence of peripheral pigmentation suggests that these scars are probably the sequel to a pustular infection other than gummatous. The reflexes are markedly exaggerated in the tendons of both the arms and the legs. This latter finding, together with the history of the periods of depression and nervousness, is somewhat suggestive of a cerebral involvement. The local process in the eye impresses me as a type of the rare, recurring, bullous erythemas, which are, occasionally, limited to this membrane alone. A differential diagnosis between this condition and a recurring, superficial, ulcerative syphilide, would, in my opinion, only be possible by definitely eliminating the latter. For this reason, I would suggest lumbar puncture and a repeated blood Wassermann. In the event of the process being a syphilide, the prognosis is good, and, for this reason, a thorough therapeutic test would also seem to be indicated, even in the absence of other findings. The prognosis, in the case of a bullous erythema, is not good, particularly in the absence of any exciting cause."

September 11, 1917. Spinal fluid Wassermann negative. Cells varied from 0 to 3 per *cmm*. Pandy's test negative.

September 12, 1917. A fresh bulla having formed upon patient's conjunctiva, the dermatologist was called again, this time unequivocally diagnosing bullous erythema. Sodium bicarbonate irrigations to the eye and citrate therapy internally were tried, but with slight temporary improvement. Later, Fowler's solution internally produced no better results.

October 17, 1917. Bullæ have been recurring at somewhat longer intervals, on both bulbar and palpebral conjunctiva, sometimes, as to-day, upon both simultaneously. In the interim the conjunctiva has become drier and drier, the palpebral being boggy and of a dull, fleshy color, the bulbar of a dusky, brownish-red hue, and both have a decided lack-luster appearance. The inferior retrotarsal fold is partially obliterated and there is definite traction between the palpebral and bulbar membranes when the lower lid is everted and the patient is told to look upward.

The diagnosis of pemphigus was made, and the patient evacuated with the recommendation that he be honorably discharged, which transpired on June 15, 1918.

The man was last heard from on December 11, 1921, when he reported as follows:

"A short time after my discharge from the Army the eye cleared perceptibly but local pain was experienced when I tried to follow my former vocation which was very dusty and heavy work. When I got away from this I was all right but, through necessity, I had to go back to it and kept trying to stick it out until I became a nervous wreck.

"To-day I am perfectly all right and my sight seems normal in both eyes. The left eye can hardly be told from any normal eye except for a slight grayish color upon the lower conjunctiva about 3mm from the cornea. [The pseudo-professional description is due to the fact that the patient has recently become an optometrist.]

"I may mention, before closing, that, in spite of all treatment, my condition did not improve until about three months after discharge from the Army."

The author has felt impelled to present this instance of indubitable pemphigus, not only because of the possible ætiological clues in the familial eye weakness and the synchronicity of the affection with the individual's military service but inasmuch as it has shown a few features which differ from the generally prevalent, text-book conception of the disease:

In the first place, as in the case so accurately described by Posey, the condition was observed in its incipient stage, though, contrary to his experience, it progressed slowly and was unaccompanied by cutaneous lesions, the latter being, in his case, atypical and diagnosed by the two consulted dermatologists as Duhring's disease.

Secondly, and in contradistinction to the majority of reported cases, it was monocular from the outset and unaccompanied by any demonstrable pemphigoid lesions elsewhere, in or on the body.

Next, the typical bullæ, owing to the fact that the patient was seen several times during the day and night for over three months, were repeatedly and easily detected, which is not in accordance with the experience of Professor Fuchs and other well known observers; moreover, the size of the same, occasionally a half centimeter in diameter, was greater than the generally accepted dimensions, while the occasional situation, partially encroaching upon the cornea, was at variance with the descriptions of most recorders.

Lastly, though Buck tells us that the disease may remain dormant for sixteen years, the customary prognosis has not proved applicable to this case, and it now appears that the affection, neuropathic, toxic, or whatever the ætiology may be, has run a self-limited course of between eighteen months and two years, and that the patient has suffered insufficient conjunctival shrinking to preclude bulbar excursions, while his cornea is practically as sound as ever, though this observation is by no means original, inasmuch as the latter has been reported as remaining transparent for as long as twenty years.

REFERENCES.

- MACLEOD, J. M. H. *Diseases of the Skin*, 1921.
SEQUEIRA, JAMES H. *Diseases of the Skin*, 3d edit., 1919.
PARSONS, J. HERBERT. *Pathology of the Eye*, vol. i., 1904.
WOOD, D. J. *British Journal of Ophthalmology*, March, 1921.
FUCHS, ERNST. *Textbooks*, 12th edit., 1917.
GEWALT. *Deutsch. med. Wochenschr.*, January 27, 1921.
WHITE COOPER. *Royal London Ophthalmic Hospital Reports*, 1858.
BRENNING. *Deutsch. med. Wochenschr.*, February 17, 1921.
STELLWAG. *Lehrbuch d. Augenheilk.*, 6th edit., 1870.
KRIES. *Arch. f. Ophth.*, 1878.
POSEY, WILLIAM C. *American Journal of Ophthalmology*, July, 1920.
RADCLIFFE-CROCKER. *Diseases of the Skin*, 1903.
SCHIESS. *Jahresb. d. Augenheilanstalt zu Basel*, 1889.
BAUMLER. *Klin. Monats. f. Augen.*, 1885.
CLAPP, C. A. *Clinical Meeting Sect. on Ophth.*, Baltimore, Md., Feb., 1922.
WHITHAM, L. B. *Trans. Amer. Ophth. Soc.*, 1919.

REPORT OF THE PROCEEDINGS OF THE SECTION
ON OPHTHALMOLOGY OF THE NEW YORK
ACADEMY OF MEDICINE.

BY DR. BEN WITT KEY, SECRETARY.

MEETING OF JANUARY 16, 1922. DR. J. M. WHEELER, CHAIRMAN.

Dr. ALEXANDER DUANE presented a preliminary report of his studies on **binocular accommodation** with a chart showing the amount of binocular accommodation in 405 cases of all ages. The progress of binocular accommodation from year to year was sensibly like that of monocular accommodation. Binocular accommodation was usually somewhat higher; in young subjects it was regularly 1-2 D. higher, sometimes more. In adults, its minimum limit was about the same as that of the monocular accommodation; its mean was about 0.3 D. and its maximum 0.5 D. higher than in the case of monocular accommodation. This fact is particularly apparent and important in cases of presbyopes of 50 or over, whose maximum accommodation was regularly as much as 1.5 D. The curve showed that the decline of accommodation due to presbyopia took place at the same rate in women as in men.

Two cases of **recurrent retinal hemorrhages** of adolescence were reported by Dr. A. E. DAVIS, in which he called attention especially to the end results of these cases.

Case No. 1, F. B., aged 22, tall blond, in 1911 had vision in each eye = $\frac{1}{2}+$. Ophthalmoscope revealed in right eye large subhyaloid hemorrhage just below the macula, with smaller hemorrhages scattered throughout the fundus, marked perivasculitis, broad white bands on sides of the retinal vessels (more marked on the veins) extending from the disk to the extreme periphery of the fundus. In the left eye were a few

small retinal hemorrhages and the same perivasculär condition as in the right.

The patient had reacted to tubercular tests pronouncedly, and was given tuberculin injections for about two years. Many recurrent hemorrhages took place in each eye, in spite of all treatment. Retinitis proliferans developed in each eye, with complete detachment of retina in the left eye. Right eye retained vision in inferior quadrant of temporal field, $\frac{1}{2}^{15}_{00}$. Hemorrhages ceased after two years, and this remnant of vision in right eye was maintained for eight years, when a cataract developed Nov. 30, 1921. This was extracted successfully and the patient's vision with +12 D.S. was restored to $\frac{2}{2}^{10}_{00}$.

Case No. 2. E. W., aged 19, tall slender blond, June 25, 1918, gave a positive tubercular family history, also history of sudden loss of vision in left eye one year previously. Four days before, June 20, the right eye had suddenly become almost totally blind.

$$\begin{aligned} \text{Rv.} &= \frac{1}{2}^{10}_{00} \\ \text{Lv.} &= \text{nil.} \end{aligned}$$

Right eye, retinal veins tortuous and greatly enlarged, large circular oedematous area surrounding the macula, with corresponding central scotoma. Left eye + 3 D. swelling at optic disk, retinitis proliferans in periphery of fundus, one or two small retinal hemorrhages. Positive general, local, and focal reaction to tuberculin. Tuberculin injections were continued but hemorrhages recurred, retinitis proliferans developed, detachment of retina in each eye; vision completely lost.

DISCUSSION: Dr. H. H. TYSON referred to a similar case of tubercular choroiditis with hemorrhages and retinitis striata, who gained weight and vision improved from fingers, excentric fixation, to $\frac{2}{3}^{\frac{1}{2}}$ + after a year's treatment with tuberculin.

Dr. A. E. DAVIS also reported the end results of a case of **Coats's disease** of the retina, which he had presented before the Society one year ago with extensive exudate and hemorrhages in the retina of the right eye, occupying the temporal half of the retina from the disk to the extreme periphery. Patient, aged ten, showed marked reactions to tuberculin

injections, local, focal, and general. He also gave very pronounced reaction following the Schieck test. Under tuberculin injections the exudate ceased to extend, the mass contracted with cessation of hemorrhages, and patient gained ten pounds.

DISCUSSION: Dr. M. J. SCHOENBERG said that not only tuberculin but also other toxins, protein toxins, diphtheria toxin, are capable of reactions in eyes with affections considered of tubercular nature, and he questioned if one is justified in making a definite diagnosis of ocular tuberculosis because of an ocular reaction after injection of tuberculin.

A case of **idiopathic cyst of iris** was presented by Dr. E. S. SHERMAN. The patient, male, aged 35, noticed in April, 1921, a small, dark spot in the left eye. The spot gradually increased in size and the vision became impaired. Two months previously vision in right eye = $\frac{1}{2}$, left eye = $\frac{6}{60}$, improved to $\frac{1}{2}\frac{1}{2}$.

Completely filling the lower half of the space between the cornea and lens was a clear, globular mass (cyst), the anterior surface of which was partially covered with remnants of atrophic iris. The inner wall, in close contact with the lens, was yellowish gray, slightly corrugated in appearance, and was crossed by two or three fine, dark blood-vessels. The mass was 8mm horizontally by 4mm in the vertical. Lower margin of the pupil was pushed up by the cyst; under a mydriatic the pupil dilated upward. Fundus and media normal.

A fine hypodermic needle was passed through lower part of the cornea into the cyst, removing 5 or 6 minims of clear watery fluid. The cyst completely collapsed, but refilled in three weeks. After tapping the cyst, refraction of the eye was less myopic by -.75 Spherical.

DISCUSSION: Dr. H. H. TYSON referred to the cause of the change in refraction after tapping the cyst as being due to change in corneal curvature from pressure by the cyst against the cornea.

Dr. E. S. SHERMAN reported a case of **hole in the macula with rupture of the choroid**. P. T., male, aged 21, was struck in the right eye by a small stone. When seen nine days later the vitreous was filled with dark opacities. R. V. = $\frac{3}{60}$. L. V. = $\frac{1}{2}$. Three weeks later, vitreous was clear.

Slightly below and to the temporal side of the macula, was a

large choroidal rupture, V-shaped, extending upward and outward. On the lower part of the rupture were two or three small areas of pigment deposit and a patch of recent hemorrhage. Near the lower part of the choroidal tear on the side toward the disk, there was a typical, dark red, circular, sharply outlined, slightly depressed spot about $\frac{2}{3}$ the size of the disk (hole in the macula). Vision = $\frac{6}{60}$. Eight weeks after the injury, the fundus appearance was about the same; vision = $\frac{6}{60}$.

DISCUSSION: Dr. H. H. TYSON thought the vision as stated was better than is found in these cases and in the absence of central metamorphosis, regarded its localization as not having been accurately determined.

Dr. J. W. WHITE reported two cases of **paralysis of associated movements downward:**

Case 1. J. H., male, aged 23. Mentally below normal. Negative syphilitic history. He had a left-sided hemiplegia, but no other ocular symptoms except loss of downward movement. No movement downward in either eye could be gotten by command, by fixing, or by turning head. No response to Graefe's test. No diplopia. Pupils normal. After three years there had been no change.

Case 2. A. B., aged 7. When $2\frac{1}{2}$ years old had convulsions and high temperature for several days. There was an epidemic of infantile paralysis at the time. Fundi normal, v. + $\frac{2}{3}0$. No attempt was made at fixation on command or on fixing the object, and on moving the head or object, fixation was not maintained. Pupils normal; fields normal; convergence less than normal.

Dr. White referred to the work of Wilbrand and Saenger, also to the studies of Spiller, and to the experiments of Tapolanski and of Bernheimer, in order to show that lesions responsible for paralysis of associated movements downward are most probably located in the corpora quadrigemina or in the oculomotor nucleus. Seven cases had been reported to date, and by the following authors: Gee, Poulard, Curson, Marie and Babinski, Basevi, Von Schroeder, and Suckling.

From his study of these cases, and the literature on the subject, Dr. White concluded that associated movements may be produced by cortical or sub-cortical centers. If

cortical the patient cannot fix on command, but will remain fixed by the fixation impulse when the object is once fixed. If nuclear there is no attempt at fixation either by command, fixation impulse, or vestibular excitation. Also that the Graefe test will prove whether the case is that of associated movements, of paralysis, or of hysteria.

DISCUSSION: Dr. ALEXANDER DUANE commented on the rarity of these conditions. He himself had not seen a case, although he had seen paralysis of upward movements. One of these was associated with symptoms evidencing a tumor of the acoustic nerve. Another was proved by Graefe's test to be supra-nuclear and was probably due to inhibition. He compared Dr. White's case of apparent paralysis of associated movements, relieved by atropine, to certain shell-shock cases of apparent paralysis of abducens which turned out to be simply a convergence spasm.

Dr. M. J. SCHOENBERG referred to a case which he reported three years ago, of paralysis of convergence and paralysis of associated movement upwards, and which he believed due to cerebrospinal lues.

Dr. KAUFMAN SCHLIVEK related the history of a boy, aged 14, headaches, vomiting, double choked disk, with paralysis of upward rotation. He suspected tumor involving the corpora quadrigemina. X-ray revealed a calculus in the pineal gland.

Dr. L. W. CRIGLER reported a case of **sarcoma of the choroid developing in an eye blinded by injury thirty years previously.**

A man, aged 69; in 1887, while working as a machinist, a piece of cast iron filing flew into his right eye penetrating the globe. Attempts at removal were unsuccessful and the eye gradually became blind. He had suffered periodic attacks of pain and inflammation, but not of sufficient severity to cause him to seek medical aid. After years of neglect, on Oct. 6, 1921, the eye presented several nodular tumors springing from the sclera in the ciliary zone, the conjunctiva stretched over them, but not adherent; cornea opaque; eyeball very hard; no light perception. Enucleation. The X-ray report for foreign body was negative; pathologist reported "large round-cell sarcoma."

Dr. Crigler pointed out that the chief interest in this case centered about the possible relationship between the develop-

ment of the growth and the trauma which occurred many years previously. Was the glaucomatous cupping of the nerve-head due to a prolonged period of hypertension antedating the onset of tumor development, or was it due to a *slowly developing tumor* which gave rise to early increase of tension? History of the case seemed to suggest the former, though if he accepted the theory of slow growth, there were points in the histology of the tumor which tended to substantiate this theory.

DISCUSSION: Dr. ANDREW A. EGGSTON stated that the sections of the extraocular masses compared with the intraocular tumor showed two distinctly different type cells. The cells of the extraocular tumor were very large, showing active mitosis. On the contrary the cells inside the eye were quite small, irregular, and appeared to be less active in proliferation. Undoubtedly pressure caused a difference in the rate of growth in the two locations. The origin of the tumor was quite definitely shown as arising from the choroid.

The causative relationship of the previous injury to the eye and the development of the sarcoma was of course one of speculation but such a relationship was logical when we know that irritation and injury in other parts of the body seem to be an ætiological factor.

Dr. BEN WITT KEY showed a case of *dermoid cyst* of the bulbar conjunctiva.

A young man, aged 20, presented a small, round, freely movable mass in the conjunctiva of the upper temporal quadrant of the right eye, midway between the lacrymal gland and the corneal limbus. Three hairs, 16mm long, growing out of the mass, were curled up in the upper fornix. Its unusual location and theory of development were of interest.

Dr. JOHN M. WHEELER reported a case of *pulsating exophthalmos* with ligation of the common carotid, followed by death.

Mrs. D. R., aged 62, first seen Dec. 8, 1921, gave a history of good health until one year before, when she became short of breath and was treated for myocarditis. No history of traumatism. For the past three weeks left eye had become prominent with orbital swelling, tenderness, and discoloration. She complained of a "hammering" sensation and constant

moderate pain on left side of the head with intermittent attacks of excruciating pain. There was palpable pulsation on pressure of either globe, more marked on the left side. A definite bruit could be heard anywhere on the head, but loudest over the orbital region on the left side. This was reduced by pressure of the left internal or common carotid.

Wassermann and urinalysis were negative; blood pressure, Sys.—185, Diast.—110; nasal accessory sinuses negative; ophthalmoscopic examination negative. X-ray report by Dr. Dixon was as follows: "The plates indicate marked pansinus-mucosal thickening. Tumor of the sella must be considered. Something in the line of the sphenoidal body (probably on the left side?) which interferes with the lateral projection of the sella."

While under observation for one week, all her symptoms became more pronounced, and after a consultation, ligation of the left common carotid was advised.

Under novocaine anesthesia, complete ligation of the left common carotid was performed by Dr. Eugene Poole. Prompt and complete cessation of the bruit resulted from the ligation and on the operating table the patient lost consciousness which was not regained.

Gradual but not complete recession of the globes followed. Right-sided hemiplegia developed and persisted. There was gradual rise in temperature to 103 degrees and the patient died thirty-nine hours after operation.

This case was reported especially to bring out the danger of complete ligation of the common carotid. An autopsy could not be obtained.

Recently Dr. James M. Hitzrot had been ligating the common carotid by a modification of Porta's method of partial occlusion of the common carotid. In response to inquiry he had written: "I expose the common carotid in the usual manner. Then take a strip of chromicized pig's bladder (Baer's membrane) about one half inch wide, fold it double lengthwise to make a band one quarter inch wide and sufficiently long to tie. This is then passed around the vessel twice, and tightened so that the pulsation in the artery distal to the ligature is just perceptible. The wound is then closed in the ordinary manner. If no symptoms arise the ligature is com-

pleted on the fourth day by reopening the wound and ligating distal to the previous ligature with chromic gut. If cerebral symptoms arise the ligature can be released by opening the wound. So far I have not had occasion to release the vessels as the temporary partial occlusion has not produced any untoward symptoms."

DISCUSSION: Dr. J. E. J. KING referred to two cases of pulsating exophthalmos which he had seen in the past six months, but stated that he did not think that immediate ligation of the common carotid was the most advisable procedure. He preferred to place a silver band about the artery and make compression, about half-way obliteration of the lumen, for a period of a week or so. If no untoward symptoms should develop, the lumen could be obliterated completely with the same band several days later. After this had proved that the blood supply could safely be diminished, the carotid could be permanently ligated and divided and the silver band removed. All of these procedures could easily be done under local anaesthesia.

Dr. ISAAC HARTSHORNE called attention to the age of Dr. Wheeler's case, 62 years, and the probable condition of the blood-vessels, hence the untoward result of the operation. He referred to a case, previously reported, of traumatic rupture of the internal carotid into the cavernous sinus, in which the common carotid was tied at one operation; vision recovered to $\frac{2}{3}$; no atrophy of the nerve.

Dr. BEN WITT KEY had studied three cases, one with Dr. Gruening in 1912 which was relieved of proptosis and the bruit, and vision restored to almost normal by ligation of the common carotid performed by Dr. Gruening himself. The second he had reported before the Academy in 1917 relieved by almost a constant digital pressure exerted by the patient himself over a period of ten days; bruit disappeared, proptosis receded, vision improved from $\frac{1}{60}$ to $\frac{2}{3}$. The third case was seen in 1918 and was the symptom of a most distressing head injury; the bruit disappeared after applying a Neff's clamp over the common carotid. He had made a study of the literature of these cases and had concluded that the ultimate near result of ligation of the common carotid had been, as a rule, only temporary relief, optic atrophy, or death. He preferred

pressure (digital or clamp) occlusion of the carotid, and believed it should always be employed before ligation is resorted to.

MEETING OF FEBRUARY 16, 1922.

A case of **tumor of the pituitary body** was presented by Dr. W. B. WEIDLER.

Miss M. L., aged 13, family and personal history negative. Headaches for past eight months (which had increased in severity and frequency), vomiting, restless sleep. Gradually decreasing vision for some months, but no diplopia. Bowels and urine regular; no polyuria. Apparently no recent increase in weight or in height in the last three years. Examination: urine and blood normal. Pupils were 3.5mm, react sluggishly to light, accommodation, and convergence. Vision O.D. = $\frac{3}{20}$ eccentric, O. S. = $\frac{6}{20}$ direct. Ophthalmoscopic examination revealed both optic nerves pale, showing progressive atrophy after a low-grade papilloedema. The fields showed bitemporal hemianopsia involving the point of fixation in the right. X-ray showed total absorption of the posterior clinoid processes with a deepening of the sella, there being a calcified mass situated to the right of the median line over the pituitary body.

Dr. W. B. WEIDLER also showed a case of **dermo-lipoma**: Mary G., aged eleven months, normal birth, no injury; several days after birth mother noticed a small pinkish mass in the outer canthus of the left eye. This had continued to grow, now about four times the size of the mass when first noticed. The tumor was freely movable and extended forward over the globe, and back on the eyeball into the socket. He said these growths were congenital, occurred usually between the insertion of the superior and external recti, and are true conjunctival growths.

DISCUSSION: Dr. GEORGE H. BELL, in discussing Dr. Weidler's case of tumor of the pituitary body, advised X-ray treatment before resorting to surgery.

In this connection he reported a case of his own,—girl, aged 18, with solid tumor which filled the sphenoidal sinuses and extended forward into the sphenoidal fissure. When first seen

by Dr. Bell, patient had optic atrophy with no vision in O.S., and beginning optic neuritis in O. D. with markedly contracted field, vision = $\frac{1}{4}0$. X-ray revealed a large tumor.

Blood and spinal Wassermanns—negative; teeth and tonsils—negative. Dr. Tousey had given her X-ray treatment, in all fifty treatments.

The optic neuritis had subsided; her vision had improved to $\frac{2}{3}0$ and her field in that eye had returned to normal. Dr. Bell plans to present this patient at some future meeting.

Dr. SINCLAIR TOUSEY said that these cases of pituitary tumors demand a great deal of study before making a diagnosis because of the angle at which they are viewed. Method of treatment given Dr. Bell's case had been, after applying goggles, to vary the parts of entry so as to concentrate the rays in different points of the tumor.

Dr. A. S. TENNER referred to a case previously reported operated upon by Cushing, and suggested X-ray treatment after operation.

A case of **paralysis of convergence and paresis of accommodation** was reported by Dr. G. W. VANDEGRIFT and Dr. R. R. LOSEY.

T. H. J., an ex-service man, aged twenty-nine, unmarried, dental student. Complaint: double vision for distance and near; first noticed in January, 1918, and developed gradually after a severe X-ray burn of occiput. Severe frontal and occipital headaches developed with the diplopia, but have since ceased. In childhood the patient had no infectious diseases, but was always subject to nasal catarrh. He did not walk till four years of age and had a tendency then to fall forward to the ground. Scars are present now on forehead from these accidents. In 1919, the year following the onset of diplopia, the patient experienced one month of noticeable sleepiness in daytime, with normal rest and sleep at night.

The patient was well nourished, healthy, with no evidence of organic disease. Family history of no importance, negative venereal history. Wassermann negative by two recent tests. No history of influenza or other infectious disease.

Neurological examination at Cornell Clinic as follows: Nervous system negative, except diplopia; nystagmoid movements of the eyes; occasional incoördination in conjugate

movements of eyes; pupillary reactions to light sluggish, to accommodation questionable; asymmetry of face; right side less used in smiling and in voluntary movements; "not multiple sclerosis, post encephalitis, or hysteria."

In 1918 sinuses were X-rayed with report that ethmoids were cloudy. X-ray (Feb. 15, 1922) by Dr. George Dixon reported:—Frontals fairly well developed, rather hazy. Ethmoids fairly clear. Antra slightly hazy. Nasal septum thick but fairly straight. Sphenoid region clear. Sella normal.

Vestibular tests by Dr. George McAuliffe: "to right and left exaggerated nystagmus for twenty minutes. Rotary nystagmus normal. Right and left past pointing exaggerated. Falling test results in falling to left both for left and right turning." These results suggest increased intracranial pressure.

Teeth X-rayed two months before showed very small abscess at root of upper canine.

Ocular examination: V. O. U. = $\frac{2}{7}0$. Under homatropine V. O. U. = $\frac{2}{7}0$ with Sph. + 1.75 D.

Media of each eye normal, fundi normal. No apparent reason for diminution of absolute vision.

Fields for color and form normal. Blind spots normal in form and outline. Pupils 3mm in width in ordinary illumination. Direct and consensual light reflexes normal. Accommodative convergence pupillary reactions absent.

Constant heteronymous diplopia for far and near with no increase in deviation and diplopia to right or left. Increasing exotropia as fixation point is moved towards the eyes. Movements of individual muscles normal in all directions. At six meters diplopia is corrected by prisms 2 degrees base in before each eye, overcoming the paralysis of tonic convergence, necessary to keep the eyes parallel. With visual lines rendered parallel by 2 degree prism base in O. U., 7 degrees of divergence power developed.

At the near point of 25cm 10 degree prism base in O. U. corrected diplopia. With distance correction (Sph. + 1.75) N. P. A. right eye 60cm, N. P. A. left eye 65cm. With the following glasses the near points of accommodation were:

Right Eye Sph. + 3.50 with prism 7 degrees base in: N. P. A.
26cm

Left Eye Sph. + 3.50 with prism 7 degrees base in: N. P. A.
27cm.

With this reading correction and with O. U. Sph. + 1 and prism 2 degrees base in for distance, the patient was comfortable and relieved of diplopia.

Dr. BEN WITT KEY presented a case of **atrophy of the uvea:**

Miss T. F., aged 21, history of loss of vision in left eye two years before, coming on rather suddenly till no light perception. No history of trauma or inflammation or pain in the eye, or headache during past two years. Previous medical history and personal history unimportant, family history negative.

Examination: Right eye normal. Left eye: lids, conjunctiva, and cornea normal; anterior chamber very shallow; iris dilated regularly, discolored, markedly atrophic; pigment layer of iris in ectropion and bound firmly and regularly to lens capsule; iris stroma retracted so that iris angle obliterated by it and broad band of pigment is thus exposed to view; pupil round, regular, moderately dilated and immobile; pupillary space clear. Peculiar cataractous formation of the lens was present—a central fibrous-like whirl of opacity anteriorly and continuous with an apparently soft and opaque lens substance. Tension had been 45 degrees (Schiotz).

It seemed reasonable to assume that there had occurred here an iridocyclitis (traumatic or other); increased tension had complicated, atrophy of the uvea followed in the usual course of events. Atrophy of the iris stroma with retraction of it and ectropion of the pigment layer, preservation of the pupillary margin of the iris; and the extent of the exposed pigment layer seemed of special interest.

Dr. D. H. WIESNER showed two cases of exudative choroiditis, which he believed presented unusual forms of pigmentation, perhaps of some pathologic significance.

DISCUSSION: Dr. A. S. TENNER referred to these cases as being of the most common type of choroiditis, and in which during the active stage of the process the choroidal pigment is absorbed almost entirely; later proliferation of pigment begins as the inflammation subsides, the late pigment deposit

depending not upon the activity of the process but upon the coloration of the individual.

The paper of the evening was presented by Dr. W. H. BROWN (Rockefeller Institute of Medical Research) on **syphilitic infection of the eye in rabbits.**

In discussing the subject of syphilitic infections of the eye in laboratory animals, attention was called to the fact that although the eye had played a prominent part in early transmission experiments, and in the subsequent growth of our knowledge of the experimental disease, the studies thus far carried out had been conducted chiefly from the standpoint of the pathologist rather than from that of the ophthalmologist. Historically, the inoculation of the eye of the rabbit by Haensel in 1881 was ranked with the transmission experiments of Klebs in the monkey and the final demonstration of the transmissibility of syphilis to the rabbit by Bertarelli in 1906 opened up a vast field for experimental investigation. The work of earlier investigators showed that the eye was highly susceptible to primary infection and it was soon found that when inoculations were made elsewhere, there was also a liability to the development of metastatic infections, especially in the cornea. Eventually, it was found that a variety of pathological conditions could be produced in the rabbit which were analogous in many respects to syphilitic affections seen in the eye of man.

These conditions were divided into two groups, the first of which included the better known affections such as those of the conjunctiva and episcleral tissues, the cornea, and the iris and ciliary body; the second group included affections of deeper structures such as the choroid and retina. A brief description of these conditions was given, accompanied by illustrations.

Among the features of eye infections which were regarded as of especial interest, attention was directed to certain peculiarities of the clinical history, to anatomical relations of the lesions, and to variations in the incidence of eye infections under different experimental conditions. Keratitis, iritis, or iridocyclitis were described as terminal events in the usual course of the experimental disease; they were usually of short duration but prone to relapse and rarely left any permanent mark of injury. These conditions were attributed to the high resistance of the rabbit as contrasted with that of man and to

the imperfect development of immunity in the eye as compared with other tissues of the animal body. It was further stated that infections of the cornea, iris, and ciliary body had a common point of origin—an infection centered about the anterior ciliary vessels at the sclero-corneal junction—the condition presented in any given instance depending upon the direction in which the infection extended.

Referring to the incidence of eye infections, it was said that this class of affections was subject to wide variation. It appeared that infection of the eyes was more prone to occur with some strains of **Treponema pallidum** than with others and that the incidence of infection with a given strain might be increased or decreased by varying experimental conditions.

Finally, reference was made to the importance of the eye as a portal of entry for syphilitic infection with or without the production of a primary lesion. In this connection experiments were described which showed that instillation of a fluid medium containing **Treponema pallidum** into the conjunctival sac of normal rabbits invariably gave rise to infection even though no injury of the conjunctiva could be demonstrated. In some instances, a lesion appeared at the portal of entry, but in others there was no gross lesion—infestation being recognized by the development of lesions in other parts of the body.

For a more detailed account of the topics discussed, the reader is referred to the following papers by Brown and Pearce: *Jour. Exper. Med.*, 1921, xxxiv., 167; *Arch. Dermat. Syphil.*, 1921, iii., 254; *Proc. Soc. Exper. Biol. Med.*, 1921, xviii., 200.

DISCUSSION: Dr. MARTIN COHEN asked why Dr. Brown made the injections into the testicle and scrotum in preference to the method usually employed—into the veins.

Dr. A. KNAPP remarked on the dissimilarity of the lesions presented as occurring in the rabbit (especially those of the conjunctiva and episclera), and those commonly found in the human eye (interstitial keratitis, etc.), and asked if the difference in the blood supply of the rabbit's eye might account for this.

Dr. W. H. Brown stated that he was uncertain as to the cause of the conjunctival and episcleral lesions being fairly

common in rabbits. He had used the skin or testicle of the rabbit as means of entrance for the injections because of the convenience of this method. He had had one animal born of syphilitic parents with interstitial keratitis from birth.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

BY MR. H. DICKINSON, LONDON.

An ordinary meeting of the Section took place on Friday, March 10th, with its President, DR. JAMES TAYLOR, in the chair.

CASES.

Circinate Retinitis with Excavation of Disk.

Dr. RAYNER BATTEN showed a female patient with a large white circular patch on the nasal side of the disk, somewhat resembling retinitis circinata. She also had a very deep glaucomatous disk, the disk cupping having been observed while she was under observation. In 1916 the vision in the right eye was $\frac{1}{2}$ and tension, pupil and optic disk were normal. In April, 1916, she complained that for six days she had had pain and the fundus could not then be seen, owing to vitreous opacities. In July, 1921, this vitreous had cleared, and then the present condition of fundus was seen. At no time was the tension of the eye above the normal; therefore he considered that cupping of the disk was due to something other than an increased tension.

Mr. HARRISON BUTLER thought this might be a case of cavernous atrophy of the optic disk.

Bilateral Enlargement of Lachrymal Glands.

Mr. THORPE showed a case of this condition in a girl, who a month ago came complaining that the enlargement had lasted five weeks. There had been no salivary gland enlargement. It commenced on the right side, and in a few days had

extended to the left. There was also conjunctival chemosis, and the eyelids were closed. There was now a tendency to improve. In a blood count the red cells were found to be normal, the whites were 14320, haemoglobin 75%, polymorphs 43%, eosinophiles 18%, lymphocytes 38%, mononuclears 1%; there were no masked cells. The color-index was .85. Though the eosinophilia suggested filaria loa, no nematode worm was discovered. There was no reason to suspect neoplasm, and his view was that the condition was tuberculous.

Mr. LESLIE PATON drew attention to the report of a case of double enlargement of lacrymal glands in the February issue of *The American Journal of Ophthalmology*. He described a case of his own, in a woman of about 40, for whom, as she was importunate, he operated and removed the glands, finding they were the seat of a simple inflammation.

The PRESIDENT spoke of a remarkable enlargement of parotid, salivary, and lacrymal glands following the taking of only 20 grs. of iodide of potassium; the swelling of them quite closed the eyes. After a time a further trial of iodide was made, starting with only 5 grs. three times daily, but the trouble following the second dose was even greater.

Specific Degeneration of Retina.

Mr. LINDSAY RAE showed a boy who, having been blind a year, since he was 6, had latterly been able to perceive bright light. The Wassermann was definitely positive. He proposed to give salvarsan intravenously.

He also showed, for diagnosis, a case of either retinitis or choroiditis. With the best correction the vision could not be got beyond $\frac{1}{2}$. She had had ten septic teeth removed.

Mr. MALCOLM HEPBURN drew attention to a large linear vitreous opacity, which might be a vitreous hemorrhage, with some fibrous degeneration over the retina. He regarded it as a choroidal condition.

An Unusual Condition of Retinal Arteries.

Mr. GRIMSDALE showed a patient with loops of vessels which he considered had a connection with the hyaloid artery, and

the lower branch of the arteria centralis retinæ. A brother was similarly affected.

Colored Vision.

Mr. P. G. DOYNE, in a paper on this subject, said colored vision was associated with a variety of conditions, physical and pathological, the most generally familiar form being, perhaps, that following exposure to snow, or which may appear to those who have had cataractous lenses removed. Mr. Work Dodd described, in volume xix. of the *Transactions* of the Ophthalmological Society, a state of green vision in a man the subject of tabes dorsalis, and in the next volume he presented records of 13 cases of the condition; 3 of them had lead poisoning, 3 were myopic, 1 had detachment of retina, 1 had tabes, in 3 there was active choroiditis, 2 had migraine, 1 had wound of the cornea with prolapse of iris. In one no details were available. Mr. Treacher Collins had told him, the speaker, that colored vision might be associated with (1) changes in the visual media of the eye, (2) after images, (3) might depend on the position in which light impinges on the eye, (4) pathological retinal and nerve irritation, (5) cortical disturbance, (6) functional.

During the last few months Mr. Doyne had collected 11 cases of various forms of colored vision, and of these he gave the leading features as described by the patients. These may be summarized as follows:

CASE 1. Male, æt. 65; vision $\frac{1}{2}$ in each eye (with correction). For a few months had noticed a dark red area in the center of the field of vision when awaking in the morning, and, to a less extent, at dusk. This cloud lasted 20 minutes, then faded away; he could see through the cloud. There was some sclerosis of the choroidal vessels, and in the macular area a clearly defined zone of colloid body formation.

CASE 2. Female, æt. 68. Occasionally had blood-red clouds in front of the eyes, and sometimes saw an appearance as of blood on her handkerchief. Had had the condition three years, but more markedly during the last 3 months. With correction, vision was respectively $\frac{1}{2}$ and $\frac{1}{8}$; a few peripheral striae were in each lens. At the macula there was a condition like that in Case 1.

CASE 3. Female, aged 41. Had ptosis of the right eye, and some scattered lens opacities in each eye; disks were pale and the Wassermann was positive. Diplopia was complained of, but ocular palsy could not be detected. No lesion of the central nervous system could be discovered. She saw a red ring, inside which were various colors, *i. e.*, blue, green, yellow.

CASE 4. Female, aged 45. The right eye was blind. With a minus 16 in front of the left eye she could count fingers, and in this eye was a big detachment of retina, up and out. One day on going out on to the hospital verandah, "everything went red," and this persisted 45 minutes after she returned into the shade.

CASE 5. Female, aged 60, a case of erythropsia following upon extraction with iridectomy, the symptoms having appeared three months after the operation.

CASE 6. Female, aged 37, who had marked bilateral optic atrophy, dilated pupils, a strongly positive Wassermann, and some dulling to deep and superficial pain in the legs. She had bare perception of light. A month ago, suddenly, after dinner, everything became a brilliant red, as if a red curtain had been drawn before the eyes. Ten days later she reported that it had disappeared, and given place to a gray cloud.

CASE 7. Female, æt. 18, with 5 D. myopia, with this corrected she read $\frac{1}{2}$ with right and left. For two months she had been seeing colors flash past her eyes when moving her head. Mostly purple was seen, but sometimes black, and occasionally other colors. This type Mr. Doyne believed to be sometimes found in cases of retinitis pigmentosa. This patient's visual fields were quite full; there was no night-blindness, and the fundi did not suggest that disease.

CASE 8. Male, æt. 23. In the macular area of the right eye there was a gray change dragging upon the retina and producing radiating folds in it. In the retina peripherally there was much glistening from the interior limiting membrane, and there were dots above and below the disk. Both daylight and bright electric lights troubled him. When tired, he noticed a purple cloud in front of the right eye, and it had a bright yellow margin: after lasting some time, the cloud broke up into smaller ones and then disappeared. Whatever color the cloud started with, it always reverted to purple.

CASE 9. Female, aged 26, who for six months had had a cloud in front of the right eye (the left was blind). The cloud appeared suddenly, was first red, then green, then black. It appeared only in the daytime. The right eye appeared normal.

CASE 10. Male, aged 45, a well-marked case of tabes, with optic atrophy. Four months ago he noticed a red mist in front of his sight, and in time it became a darker red.

CASE 11. Male, aged 38, whose left eye was blind, and the right had 6 D. of myopia, and during the last few days had been failing. A fair-sized hemorrhage at the macula could be seen, with smaller outlying ones. The patient described seeing a black ring in front of the eye, and when he shut his eyes, he could see a green ball.

Mr. DOYNE said the two cases which interested him most were those having the colloid body formation, as the ophthalmoscopic appearance in these was so definite and the area of change so clearly defined. Yet this type of degeneration was not uncommon, and he was not aware that red vision was usually associated with it. In the first of the related cases the phenomenon was noticed on first waking and in twilight, *i. e.*, times when a change in the stimulation of the retina was taking place. He asked whether, on the assumption that the colloid body formation interfered somewhat with the nutrition of the retina, it could be reasonably supposed that the retinal elements, which was stimulated by red rays, had a lower threshold.

Mr. M. S. MAYOU related a case of the kind which he had had, the subject being a taxi-cab driver, and he dare not take his car out at night as he saw approaching lights as a red wall, and could not discern whether lights were approaching or receding. Nothing wrong was found in the fundus, but probably there was present some arteriosclerosis. He was about 50 years of age. He got much better in 4 months, and resumed work.

Mr. LESLIE PATON spoke of the number of cases of tabes which reported having green vision, and the small number who saw red. One or two tabetics were recorded as having purple vision, and some had a green meshwork with a purple field. In the transient amaurosis associated with cerebral tumor definite color scotomata were recorded. Cases of migraines

sometimes saw flashes of purple balls in a green field, and green balls in a purple field.

The PRESIDENT referred to cases of optic atrophy in which a pale blue mist came over the eyes with the onset of twilight.

Mr. FRANK JULER spoke of a case of his in which a medical man had his cataract extracted, and five months later said he had purple vision. The patient's own suggestion as to the cause was that some change had been induced in the reaction of the visual purple by the excess of blood which got in, a disturbance of the vitreous probably acting chemically on the retina; not a fatigue phenomenon, as it was worst when first awaking in the morning.

Mr. R. A. GREEVES spoke of a patient under his care who had central cataracts, and to whom he gave weak atropine drops; but she discontinued using them because when she went out of doors everything looked green, and when she returned the home looked red.

Mr. W. T. HOLMES SPICER remarked on the fact that immediately after cataracts were removed the patients saw everything blue. Subjects of retinal hemorrhages saw patches of blood in their own retinae. A sudden drag on the eye muscles produced, in him, a brilliant-edged purple light. Fuchs said that after a cataract extraction the eye had no longer the protection of the semi-opaque lens, and when it entered a bright area, such as amid a fall of snow, erythropsia resulted; that the bright dazzle exhausted the visual purple, and there followed a rapid re-secretion of visual purple.

Mr. R. R. CRUISE suggested that in patients at or past middle life arteriosclerosis might be a causative factor.

Mr. DOYNE replied.

PAPER.

Mr. R. AFFLECK GREEVES: A Series of Sympathizing Eyes Examined Microscopically.

Mr. Greeves said only a few observations had been made on the sympathizing eye, though many were made on the exciting eye in sympathetic ophthalmia. Fuchs, in 1893, sought to show that the microscopical changes in the exciting eye

were so constant as to enable a diagnosis to be made merely from the sections of the eye. Most books stated that the changes in the sympathizing eye were identical with those in the exciting eye. In two cases which he had examined, however, there was a definite difference, and he now demonstrated on the screen sections from ten cases. These showed that the character and extent of the inflammatory changes did not depend on the duration, nor on the period between the injury to the exciting eye and the onset of the trouble in the sympathizing eye. In four of the cases the infiltrating cells were purely lymphocytes and plasma cells; in five epithelioid cells were present, and in three of the five a few giant cells. The only constant factor in all the cases was irido-cyclitis, varying in intensity and character in different cases. In five cases in which the cornea was infiltrated the infiltrating cells were lymphocytes and plasma cells; there were no giant cells. The posterior part of the choroid was never more densely infiltrated than the anterior, which was the rule in exciting eyes. There was some involvement of vitreous. The optic nerve was normal in three cases, oedematous in five, and in only one case was the nerve sheath infiltrated. In three cases, which had not been operated upon, there was rupture of the lens capsule, and in two of these the iris and the swollen lens matter formed a necrotic mass. In these two the tension of the eye was low, in the third there was the usual secondary glaucoma. Organized plastic exudation was present in four cases, and this fact was against Fuchs' view that plastic exudation in sympathetic disease, which was invariably present in exciting eyes, was due to a secondary infection, and not part of the actual process. The cases showed that there was no special characteristic of the sympathetic process, as shown by the microscope, which was of constant occurrence in sympathizing eyes.

Mr. M. S. MAYOU spoke of deposits beneath the epithelium in cases of sympathetic ophthalmia, and he showed slides of two cases which demonstrated this; there was a deposit of fibrous tissue between the epithelium and Bowman's membrane.

NOTICE.

The undersigned beg to announce the establishment of a special course for postgraduate study in OPHTHALMOLOGY, to be given during eight weeks between October 2 and November 25, 1922, at the I and II EYE CLINIC of the Allgemeines Krankenhaus, Vienna.

Prof. Meller and Prof. Dimmer, chiefs of the clinics, have consented to active participation. In addition Dr. Bachstetz and Dr. Lindner and Dr. Guist of the II EYE CLINIC will give courses. Dr. Hirsch and Dr. Kummer will lecture on the hypophysis and on radium in relation to the eye. The entire material of both clinics will be at the disposal of the staff for the purposes of instruction and demonstration. The course has been so arranged that in the two months period the field can be covered in quite a systematic and fairly comprehensive way. A weekly colloquium attended by all members of the staff and class will provide for an exchange of opinion and discussion.

The entire course will be in English. The fee will be \$200.00. Application, with certified check or draft in dollars to the amount of \$50.00, should be in the hands of Dr. Adalbert Fuchs, I. Augenklinik, IX. Alserstrasse, 4, Vienna, by August 15th. The course will be given for a minimum of ten, and a maximum of fifteen members. As early an application as possible is therefore advisable. The detailed plan of the course follows:

Hofrat Dimmer	Photography of the Fundus	2 hours
Prof. Meller	Operations	30 "
" "	General Diagnostic	10 "
Doz. Lauber	Physiology and optics	20 "
" "	Examinations (Red-free Light Slit-lamp)	28 "

Doz. Lindner	Refraction	20	"
" "	Bacteriology	20	"
" "	Retinoscopy	8	"
Doz. Hirsch	Hypophysis	2	"
Doz. Kummer	Radium Therapy	I	"
Doz. Bachstetz	Muscles	20	"
" "	Neurology	8	"
" "	External Diseases	28	"
Doz. Fuchs	Anatomy of the Orbit	8	"
" "	Normal Histology	10	"
" "	Pathological Histology	30	"
" "	General Therapeutics and Local Anæsthetics	3	"
Dr. Guist	Ophthalmoscopy	40	"
Doz. A. Fuchs and	Colloquium, one evening each week		
Doz. Lindner			

E. FUCHS.

ARCHIVES OF OPHTHALMOLOGY.

CORRECTION OF SQUINT BY MUSCLE RECESSION WITH SCLERAL SUTURING.

BY DR. P. CHALMERS JAMESON, BROOKLYN, N. Y.

(With four illustrations in the text.)

SIMPLE tenotomy was the earliest operation performed for squint. Deffendorf divided the belly of the muscle, the muscle retracted, did not unite with the sclera, paralysis followed, and the operation fell into disrepute. Bohn introduced the method of to-day, and Von Graffe, Knapp, and others followed with suggestions as to securing and regulating the effect. Even with these guides to regulate it has always been an uncertain operation, sometimes giving brilliant results, holding and maintaining them, and again proving a disappointment, giving way, retracting the caruncle, and wholly or partially paralyzing the muscle. Its uncertainty is attributable to one very unreliable factor, namely, the question of muscle union or fixation with the sclera.

If the muscle should happen to form its reattachment to the sclera at the point desired of course it is successful. If it should curl up, make a conjunctival attachment, retract within its sheath, drop behind the contact arc, it may be a partial, or complete and disastrous failure. These conditions while not as applicable to the partial or guarded tenotomies as

¹ Read before the American Ophthalmological Society, Washington, D. C., May 1, 1922.

practiced to-day, cannot be altogether eliminated and the danger is in ratio to the extent of the partial tenotomy done and to the attenuation of the muscle produced.

It was with these facts in mind coupled with the thought that a muscle could and should be receded with the same exactness and precision that it could be advanced, that the writer was prompted to seek the means, and also endeavor to find the limits of its utility.

To find this it was necessary to demonstrate the stabilization of the scleral tissue behind the muscle insertion as a suitable and practicable suturing medium, and to devise a technique by which the operation could be easily and satisfactorily performed.

Scleral suturing had been practiced as a successful procedure in front of the muscle where the episcleral tissue is dense and abundant. It has not however been utilized to any great extent behind the insertion of the muscle.

Since writing this paper I have received a reprint of an operation by Dr. Curdy of Kansas City describing a one suture recession operation, with scleral suturing to the superficial sclera. This he does coincident with a similar advancement on the opposing side. It appeals to one as an ingenious and practical operation.

Beard states that Prince of Springfield practiced a recession operation with what he called "tenotomy with control suture." Colburn, in 1889, practiced a similar tenotomy with "restrain suture" and he himself practised an operation under the caption of curb tenotomy. He did not practice scleral suturing but sutured to Tenon's capsule.

The following paper is a study of 56 operations of recession without advancement in which deep scleral suturing short of perforation is practiced.

The operation about to be described freely exposes the muscle and after detaching it, separates it from the globe, as also its capsular continuity above and below, leaving however its sheath intact.

It transplants it at once to a position placed further back and permits the operator to accurately grade the operation, and by scleral suturing, gives him a definite understanding of the location of reattachment. It also establishes a safeguard

against future retraction, and it introduces and elaborates a technique for safe scleral suturing.

Every new operation is an interrogation point, and in this vein I venture to present the operation, feeling justified by the results obtained in this preliminary study.

The operations have all been performed upon cases of internal concomitant squint with two exceptions.

The following are the steps of the operation.

A conjunctival incision is made about seven millimeters long following the curve of the semi-lunar fold, the center cor-

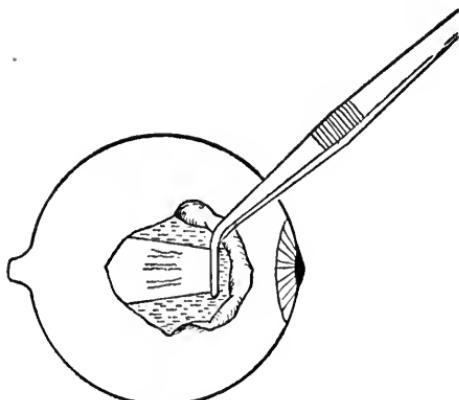


FIG. 1.—Muscle exposed. Capsular incisions pass backward beyond equator.

responding to the caruncle. The ends of this incision are prolonged toward the cornea and in the direction of the fornici above and below. The flap is undermined to its base and turned over toward the cornea. The semi-lunar conjunctiva is also undermined in the direction of the caruncle, with care not to disturb the fascial trebeculae or areolar tissue on the surface of the muscle.

The muscle is now undermined, completely separated from the globe, and its capsular continuity severed above and below by incisions carried back beyond the equator. A tenotomy hook is inserted to facilitate clean dissection, and Reese forceps, placed behind it, grasp the muscle. The hook is withdrawn and the muscle severed from its insertion in the usual way.

It is an advantage to have the operative field completely

exposed and ample room to manipulate the needle. The sclera now exposed should be sponged and cleaned of blood particles and the outlying muscle fibers, if any, freely severed.

The distance from the muscle insertion which the operator desires to recede the muscle end is now measured in millimeters and the point noted on the sclera. The remaining steps in the operation are very simple.

Three single armed sutures are provided. The first, the central one, is introduced from without the conjunctival lip

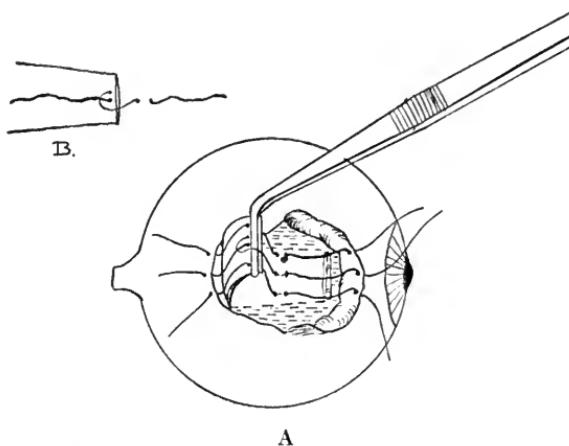


FIG. 2.—A. Muscle ready for recession. Three sutures introduced through conjunctiva, muscle, sclera, and again through conjunctiva. B. Detail of central suture.

nearest the caruncle, then perforates the outer surface of the muscle end, just below the center behind the forceps. At this point to make for the utmost safety in the bite of the suture, the needle is put through the muscle from the under side above its first perforation (that is just above the center of the muscle) and is brought out on the upper side of the muscle, the thread being looped around the thread of the first perforation. This simple suture is easily seen on the diagram. The sutures are now continued right on through the sclera and out and finally through the lip of the conjunctiva nearest the cornea. The two remaining sutures, about three millimeters above and below the center, are carried directly through the conjunctiva lip, muscle end, sclera, and conjunctival lip nearest the cornea.

The sutures are now carefully separated, the blood debris cleared away, the muscle approximated to its new scleral attachment.

The tying of the sutures firmly holds the muscle to its new scleral position and at the same time closes the conjunctival

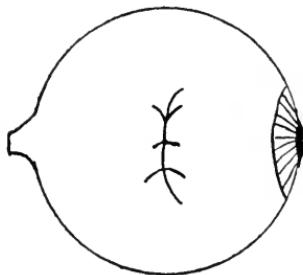


FIG. 3.—By tying the sutures the conjunctival wound is closed and the muscle, at the same time, is brought to its new point of attachment.

opening. The central suture resolves itself into a surgical knot and tightly holds a bundle of muscle fibers in firm apposition to the sclera. If the conjunctival wound gaps between the sutures, it is wise to supplement surface conjunctival sutures.

It will be found an advantage after the sutures are tied to leave the ends long enough to be loosely held out of the way by an adhesive strip to the bridge of the nose. It greatly facilitates their removal to be able to abduct the eye by traction through them. The knots can then be pulled into view. They can be removed on the sixth or the seventh day.

Certain precautions should be observed in order to make a smooth and facile operation. The conjunctiva should be carefully separated leaving the supra-muscular tissues intact. The areolar tissue in which the muscle is deeply imbedded in the region of the caruncle should not be sliced. If this is done the muscle is endangered, the anatomy disarranged, and the reaction will be greater.

It is of great advantage to leave the mass of fat and fascia in which the muscle is embedded posteriorly intact. It not only preserves the anatomical relationship of the parts but leaves a compact mass of tissue in continuity with the capsular incisions above and below which unites and adds to the strength of the scleral attachment.

The needles should be small, 10 millimeters from tip to eye, full curved and sharp. A large blunt needle would endanger the operation. The thread should be No. 1 or 2 twisted silk.

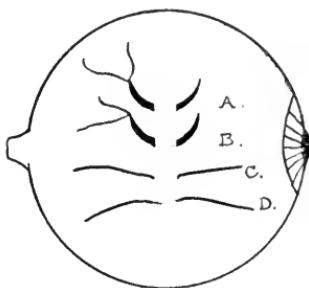


FIG. 4. Illustration of scleral suturing. A. Needle perforating the sclera. B. Non-perforating needle. C. Suture of perforation. D. Suture of non-perforation.

The stabilitment of the sclera, the first thing to be questioned in connection with the operation, is a most clearly demonstrable fact. The sclera, formed, as it is, of white fibrous and yellow elastic fibers in bundles having an equatorial direction and also lying in meridian lines, makes the best structure for engaging of a needle.

The strength of these fibers is remarkable as the following experiment showed. A freshly enucleated eye was sutured with No. 1 twisted silk and the thread was looped. The globe was then opened to make assurance the needle had not perforated, which was found to be the case.

The excised section was firmly held between the hook forceps and articles of various weight were added one by one to the loop. They weighed one pound and one half ounce and the sclera still held. Three sutures will hold three pounds one and one half ounce without tearing out, and probably more.

The technique of introducing scleral sutures in order to obtain the deepest bite without perforation is important. The sclera is less than one millimeter thick in and around the equator and may be easily perforated. A thick large needle may burst the fibers, a sharp small slender needle will split the bundle layers with facility if handled as follows:

The needle engages carefully at first and the point, which should always be watched and visible, picks up a bundle of

fibers and as the point of the needle becomes indistinct it is made to approach the surface but not to pass through the surface, steady pressure being exerted as it makes its way through the tissue and engages in its bend substantial bundles of fibers. The motion employed is such as one would use in picking up the fibers of a thick linen handkerchief bent over the finger without pricking the finger.

The bend of the needle after counter puncture should be seen in its entire continuity through the translucent sclera as also the suture after it has been drawn. Such a suture has not perforated.

Performed after this manner scleral sutures will hold and can be manipulated with the greatest confidence and equanimity. With a perforating suture, neither the needle bend or thread can be seen as they pass through the sclera.

If the operator should strike a small vein the non-resistance is at once detected, the point withdrawn and introduced one millimeter in any direction. The two dangers, unsuitable anchorage and perforation, commonly cited as precluding scleral suturing in this region are found to be groundless and erroneous. The above technique opens a field of wide practicability for scleral suturing in muscle operations.

The reaction and trauma is moderate if the operation has been performed smoothly. In a former operation the sutures were tied over rubber banding and the local reaction was considerable. The simple operation just outlined makes the reaction negligible and local. In none of the cases has there been any deep reaction. In no case has there been general conjunctival chemosis. None of the cases showed interior involvement of the globe. Post-operative granulations are easily removed.

Retraction of the Caruncle.—There has been but slight retraction of the caruncle and that difficult to distinguish and of negligible quantity. The writer is conversant with the painstaking work and investigation by Dr. Howe and others on caruncular retraction. As the result of these observations on operations so near this structure he would add this contributive suggestion, that the muscle firmly attached to the sclera at or in front of the equator, is the beam that holds these tissues in normal anatomical relationship. If this, the muscle

attachment, gives way, all surrounding tissues are dragged backward and with them follows retraction and slight inversion of the caruncle.

The Determination of the Amount of Recession.—Taking the equator as the possible limit to which a muscle should be receded the average distance between the insertion of the internal rectus and the equator is not probably more than five and at most six millimeters, the measurement depending on the diameter of the cornea, the distance between the insertion of the muscle and the limbus, and the age of the patient. These, therefore, should be measured and the computation reckoned before the recession is made.

The indications as to the amount of recession conform to those in general usage together with certain observations gained from the operations done. Among these is the degree of squint, fixed, alternating, or periodic. A greater degree of recession is necessitated if the squint is fixed. Marked correction of squint with glasses should lessen the recession. Then there is the excursive power of the opposing muscle. Divergence insufficiency would increase the amount of recession to be done. The age, duration of squint, and the visual acuteness of the deviating eye are all to be taken into consideration.

The length, size, breadth, and the laxity or tension of the muscles are important factors in estimating the amount of recession. Frequently a short, tense, powerful muscle is to be found on the non-deviating eye, equal in size to that of the deviating eye.

The rule of one millimeter to each five degrees of deviation has not been strictly adhered to. Certain broad limitations have been found practicable having for their object the protection of convergence with the greatest amount of correction.

In operating upon the strong muscle we have generally found it a safe procedure to recede to the five millimeter limit if the deviation is over twenty-five degrees and if scleral fixation is practiced. In doing a double recession we have found safety in receding to four millimeters on both sides if the deviation is over forty degrees and if scleral suturing is practiced. Modifications from these extreme limitations, the operator applies to individual needs.

Certain factors, however, which come under the heading of post-operative adjustments cannot be wholly estimated before operation. Principal among these are—first, the post-operative neuro-muscular element; second, the indefinite knowledge before operation as to the adductuve contributions of the supplementary adductor muscles; third, what Jackson termed the connective tissue influences. They, the post-operative neurological, muscular, and connective tissue obstructions, are contributory causes of failures or partial failures in well regulated operations and contribute an erratic quality to final results.

They are the post-operative obstacles which muscles newly placed have to contend with. Whitnall states, "that in a firm body such as the eyeball revolving against a cushion of fatty tissues the fat will be pressed away and the connective tissue meshwork supporting it condensed with a membrane-like surface."

It is reasonable that an eye deflected laterally for a number of years must have shaped a socket for itself differing from the normal and that connective tissue contractors and atrophies, adapted to the new position of the globe, take place.

But a knowledge of the extent of these contractures can sometimes be acquired at the time of the operation. If the stump of the muscle after detachment is grasped and the eye forcibly rotated outward impediment to free excursion is often noticed, and the operator can take advantage of this fact to incise the capsule equatorially above and below.

That connective obstructions are not the all-important factors that newly placed muscles have to function against, and that neuro-muscular conditions play an important rôle, is proved by the fact that the weak abductuve muscle, as a rule, experiences no difficulty in rotating the eye freely to the outer canthus, as also by the truth that in double recession the operation on the non-deviating eye frequently contributes a large amount of correction. That the muscle of the opposing non-deviating eye is often of as large a caliber, short and tense, as that of the deviating eye is undoubtedly one of the reasons for this contribution, and a very potent argument for a double-sided operation.

Results of Operations.—There have been thirty-nine patients upon whom fifty-six operations have been performed—twenty-two of these upon whom single recession was done and seventeen upon whom double recession was performed. The early operations were all single recessions. In the later operations the effect was divided between both eyes.

The total number of degrees of squint of the twenty-two cases of single recession was 655 degrees. The uncorrected residue two weeks after the operation was 117 degrees. Of these twenty-two single recessions five were under 25 degrees and all were corrected. The remaining seventeen, therefore, left an average of 6.9 degrees. Ten of these single recessions were over 30 degrees: five were 40 degrees or over. They of course were beyond the corrective possibility of a single recession operation.

These results point to the limit of a single recession of five millimeters with scleral fixation as being 25 degrees, or, at most, under unusual post-operative, non-obstructive conditions 28 degrees. Beyond this an interfacial or aponeurotic attachment is likely to exist.

The total number of degrees of squint in the seventeen cases upon which the double recessions were performed was 636 degrees. The uncorrected degree of squint after operation was 64 degrees, an average of 3.8 degrees for each case. Fifteen of these seventeen cases of double recession were over 30 degrees, nine were 40 degrees or over. Fourteen of these seventeen cases were corrected within 5 degrees.

None of these 56 cases have diverged perceptibly for distance. A few of the amblyopics have faltered in convergence before the five centimeter point was reached but within two weeks after operation have improved as the wounded muscle recuperated. Moreover, it is an interesting fact that faltering convergence may be expected immediately after the recession operation but that convergence is regained when the wounded muscle is healed. With the exception of four cases which faltered at 3 millimeters they have adducted to the caruncle.

These operations were performed on cases kindly turned over to me by my associates at the Brooklyn Eye and Ear Hospital together with those of my own clinic and private

practice. They, my associates, have in most cases witnessed the results.

Through the courtesy of Dr. Wheeler I operated upon two cases at the New York Eye and Ear Hospital. One was a squint of 30 degrees, the other of 35 to 40 degrees. A double recession was performed on the thirty-five degree squint at two sittings which resulted in correction and preservation of convergence. The second case upon which a single recession was performed left a residue of 15 degrees, and has not yet been operated upon again.

Also through the kindly invitation of Dr. Knapp two operations were done at the Knapp Memorial Hospital. On a deviation of 45 degrees a double recession was performed. This case perceptibly diverged during the first week. Three weeks after he had a slight convergence of about 5 degrees. On the second case, a 50 degree squint, a single recession was performed. It corrected 27 degrees of the deviation, and abduction, which faltered at 5 millimeters from the canthus before the operation, was also corrected. This case was advanced later as the patient desired that one eye alone be operated upon.

Of the lesser degrees of deviation one of only five degrees, the residue of an operation performed many years previous, was receded three millimeters. Ten days after operation he had twelve degrees exophoria, three weeks after operation, seven degrees exophoria with correction of the aforesaid deviation.

SUMMARY OF USEFULNESS OF OPERATION.

1st. It primarily attacks the offending muscle and puts the greatest emphasis where the seat of the deformity begins.

2d. It leaves an unmutilated muscle system with a broad properly placed attachment capable of normal action and vigorous work.

3d. It enlarges the effect of tenotomy by boldly carrying the muscle end back to the equator if necessary. The exposition of the field enables the operator to make valuable observations relative to the length, breadth, laxity, tension, and connective tissue obstructions. It enables him to grade his

operation accurately, insures a non-pointed attachment, and leaves him with a definite understanding as to where his muscle is fixed, and renders tenotomy by reason of scleral fixation a safe and reliable procedure.

4th. It safeguards convergence to a striking degree. This has been the most gratifying outcome of the operations performed, and is attributable to the fact that a powerful muscle properly and broadly attached to the sclera, working from its primary origin at the optic foramen, and from its secondary action or origin from the diversion of the check ligament, and supplemented by accessory adductor muscles, is a bulwark for the preservation of convergence.

5th. Its corrective capabilities are extensive and comparatively uniform.

A single recession of five millimeters with scleral fixation will correct a deviation of 25 degrees in a high percentage of cases.

A double recession of four millimeters on both sides with scleral fixation will correct deviation of 35 degrees or above in a high percentage of cases.

Finally, the operation of recession with scleral suturing has all the traditions for good which tenotomy has accomplished in the past and provides that very important feature which it lacked, namely, definite scleral fixation.

THE FILTERING SCAR.¹

BY LT.-COL. R. H. ELLIOT, LONDON, ENGLAND.

(*With eight illustrations on Text-Plates XVII. and XVIII.*)

THE importance of clear conceptions on the subject of the rôle of the filtering scar in glaucoma surgery is paramount, and yet, after all these years of work there is still the widest variation between the views held by men of large experience. Some of these ideas, I hold to be most misleading, and I therefore desire to bring the subject before you once again, in the hope of clearing the ground, and helping to establish a firm foundation for our future building. I have from the first held very definite ideas as to the nature of the ideal filtering scar, which is the end and aim of the glaucoma surgeon. Time has only served to strengthen my beliefs, and the present paper is an effort to point out what to my mind is the real position of the subject.

Von Graefe, as a result of his experience with iridectomy, had dimly appreciated the possible rôle of the filtering scar. De Wecker saw its great possibilities with a clearness of vision that must ever be accounted to him for genius, but it was left to his distinguished countryman Lagrange to turn his dream into actuality by presenting surgery with the epoch-making idea of a deliberate sclerectomy.

The fluctuations in the tidal advance of science are too well known to need comment, but to me it has always seemed little short of lamentable that the surgeon of the 20th century has been so slow to grasp the importance of the great truth which the work of these three men has presented us with. You may

¹ Read before the Section on Ophthalmology of the New York Academy of Medicine, April 1, 1922.

argue endlessly in academic discussion as to the source and method of excretion of the intraocular fluid but, whilst you are doing so, the practical clinician with his patient's sight dependent upon him, will brush aside your weighty and interesting arguments under the burning stress of a need to establish an outflow channel for the aqueous fluid. It matters not to him where the excess comes from. He knows that the eye is hard by reason of that excess, and that the optic nerve and all the other important structures of the globe are steadily perishing under the influence of this increase in the intraocular pressure. He knows too that if he can establish a permanent vicarious channel of escape for the excess fluid, the damage that is being done will be brought to a stop and the sight will be saved. We, many of us, differ on details but the great mass of us unhesitatingly accept these as the daily facts of our struggle with glaucoma.

I hold still, as I have long held, that a very large element in the success of iridectomy has lain in the fact, so long ago pointed out by von Graefe, that a large proportion of the successes attributed to this operation should go down to the credit of the accidental establishment of a filtering scar so frequently obtained as a result of this procedure. This opens up too big a subject for me to discuss here, but one thing, at least I think, you will all concede me, viz., that in a very large percentage of glaucoma cases, the failure to obtain a filtering scar means the failure to relieve the patient.

What is the ideal filtering scar? The answer we decide to give to this question is most important. On its correctness depends our hope of future progress; this is no mere academic subject; on the contrary, it is an intensely practical one. With such considerations before me, I shall endeavor to answer the question at some length, trusting you to realize that the paramount importance of the correctness of our conceptions justifies the course I am taking.

The ideal filtering scar must be (1) permanent, (2) efficient, and (3) safe. We must not forget that the filtering scar is divided into two parts, (1) the fistulous track, through the sclero-corneal tunic, and (2) the overlying pad of conjunctiva and subconjunctival tissue.

(1) *The Permanency of the Fistula.* This depends on a num-

ber of elements. (A) *The Asepticity of the Parts Concerned in the Operation.* We have long known that aseptic wounds in the iris when bathed continuously in the aqueous fluid, show no tendency to tissue proliferation. It is quite clear that the same applies to the other structures of the eye, and that a clean-cut aseptic wound of the sclera or cornea remains indefinitely in the same state as it is left in by the operation.

(B) *The Manner in which the Fistula has been Made.* The less the trauma inflicted, the less is the likelihood of proliferation of the sides of the canal; it is obvious that any such proliferation will tend to block the patency of the fistulous track. Holth has recently shown reason for the suspicion that one of the means by which a trephine or other wound may close up, is the filling up of the canal by such a tissue proliferation from its edges.

(C) *The Absence of Impaction of Uveal Tissue in the Depth of the Fistula.* I have always looked on this as by far the most important factor in the whose case, and I hold as strongly as ever that the glaucoma surgeon's great desideratum is an iris-free scar. To the attainment of this end his every effort should be bent; success in this detail is the surest guarantee of permanent filtration. It is true that there are many points to be taken into account, but this dwarfs all others. Later on we shall have occasion to speak shortly of those procedures in which iris is deliberately included in the operation wound with a view to establishing a filtering scar. For the present we shall confine ourselves to the consideration of the accidental inclusions:

a. Whatever may be the experience of surgeons who perform other operations, those who use the trephine know well that there can be no better augury of success than the absence from the trephine hole of any evidence of the impaction or even of the introduction of uveal tissue. This is a clinical fact which admits of no dispute.

b. Quite a considerable amount of anatomical evidence has been forthcoming of recent years to show that excellent and satisfactory filtration can be obtained in the absence of uveal impaction. We owe to Professor Holth a large part of the work on this subject to which Lagrange, Verhoeff, and others have also contributed. Holth was originally of the opinion

that the establishment of a filtering scar depended on the lining of the walls of the sclerectomy wound with uveal pigment. The photographs in his most recent paper do not appear to bear out such a contention but fall into line with the anatomical findings of Verhoeff and with my own. If I read him aright Holth has evidently taken this view in the light of his more recent and very valuable work. You are doubtless familiar with Verhoeff's excellently recorded case, and also with the one which I have published (Figs. 1 to 4). I would like to direct your attention also to the section of an eye which I had the opportunity of examining, and in which a permanent scleral fistula was present following the couching of a cataract (Figs. 5 and 6). You will observe that though there is some accidental impaction of uveal tissue in the depth of the wound, the main part of the fistula's track is quite clear of it.

It is necessary to turn aside for one brief moment to point out that in glaucoma, as in cataract operations, there is an important difference between a clinically iris-free scar and the same condition anatomically. The latter must be very rarely, if ever, met with, whilst the former can be attained very frequently by the adoption of a correct technique. No one looking at Figs. 1 and 6 can pretend that the fistulæ are lined throughout by uveal tissue, which, if the maintenance of fistulization were dependent on the uveal lining, we should expect they would be. It is obvious in both these cases that such uveal impaction as existed was accidental, and that it was certainly not favorable to the maintenance of free fistulization. Verhoeff's sections are even more convincing on this point.

c. The examination of a number of eyes, in which the trephine hole had become blocked by the proliferation of connective tissue, has shown the presence of pigmentary material in a large number of the wounds, thus suggesting a cause and effect relationship between the entanglement of the uveal tissue and the subsequent blockage of the wound. It is not surprising that there is much more evidence on this side than there is on that which we have just been discussing, for successfully operated eyes seldom reach the pathologist, whilst the failures do so as a matter of routine. May I urge on every one of you the importance of obtaining successful filtering

scars for section whenever possible after the death of a patient. I have not the slightest hesitation in prophesying that the more of such material we accumulate the more firmly we shall establish the important principle of the value of the iris-free filtering scar.

(D) *The Nature of the Operation Performed.* Whilst it is beyond dispute that operations such as sclerotomy and iridectomy may, and not very frequently do, result in the establishment of permanent filtration it will unhesitatingly be accepted by most of us that the rational procedure is to undertake a carefully planned sclerectomy. At the same time we are bound to ask ourselves why it is that these other operations are sometimes successful. Collins has pointed out—and from the clinical point of view I wholeheartedly agree with him—that it is important to include in a keratic-sclerectomy the whole thickness of the tunic of the eye, inclusive of its deepest layer, the membranes of Descemet. Incidentally I may mention that I have demonstrated anatomically that in trephining the membrane of Descemet and the adjacent part of the pectinate ligament can be completely removed over the whole area covered by the blade of the trephine. (Figs. 7 and 8.) How is it then that a mere incision of the parts concerned may undoubtedly result in well-marked fistulization? In attempting to answer this we remind ourselves of the absence of proliferation in aseptic iris wounds, and of Fuchs' observation that even a transfixion of an *iris bombe* may result in the formation of a permanent fistula through the iris. The suggestion that obtrudes itself is that, given any measure of tension on the parts sufficient to convert the incision from a potential slit into an actual passage which can be bathed in aqueous fluid, the tendency to direct healing is in abeyance, and the wound remains a fistula. If we could rely upon this being always the case, the problem of the glaucoma operation would be a simple one. Unfortunately we cannot, and we must therefore plan for the definite removal of a certain thickness of the whole of the ocular tunic, inclusive of the membrane of Descemet. Hence the present position of the Lagrange operation, the Holth's operation, and my own.

One point more before we leave the technique of the operation: A grave menace to permanent fistulization lies in the

plugging of the wound by the downgrowth of corneal or conjunctival epithelium. It is therefore essential to use large flaps in order to remove the external wound as far as possible from the neighborhood of the fistula. It is also important to avoid button-holing of the flap. You will doubtless remember that I have from the first advocated the employment of large flap, and that a number of other surgeons have, of recent years, adopted the same technique, performing their own operation under what they have been kind enough to speak of as "the Elliot flap."

(E) *The State of Health of the Patient.* A sclerectomy, be its nature what it may, may have been most skillfully and aseptically performed with the result that convalescence appears to have run absolutely unimpeded, and yet the fistula may close up; there may be no visible evidence of inflammation, but filtration gradually ceases, and the opening through the sclero-corneal tunic steadily becomes less and less obvious, its place being taken by an opaque thickening of the parts. I think that we must blame this complication to an auto-intoxication, the result of some focus—syphilitic, tuberculous, inflammatory, or of some other nature—which has been overlooked. The clinical importance of the observation is very great, for if we wish to avoid renewed failure, after a second operation, our only course is to submit the patient to a thorough examination for the cause of the trouble and if this is found, to treat it effectively and thoroughly.

We may pause here for one moment to summarize what has already been written, doing so from a slightly different angle: The fistula may become blocked in a variety of ways: (1) This may occur owing to a fault in our asepticity, which may affect the conjunctival and subconjunctival tissue, causing them to mat over and block the outer orifice of the canal; or it may affect the walls of the canal itself leading to tissue proliferation and so to closure of the channel; or it may start in the uveal tissue in the depth of the wound. An unhealthy systematic condition of the patient may lead to the same results. (2) The block may be due to a mechanical plugging of the deep end of the canal by uveal tissue. (3) The channel which has been made may close up by the union of its adjacent surfaces especially in its deepest part. (4) Given defective

operative conditions, the fistula may be closed by the down-growth of epithelium from the surface of the wound.

(2) *The Efficiency of the Filtering Scar.* It is obvious that no filtering scar can remain efficient unless the fistula which feeds it is a permanent one. For this reason each one of the factors which have been discussed under the previous heading has a strong bearing on the efficiency of the filtering scar. When, however, we ordinarily speak of efficiency in this connection, we have a somewhat different idea in the forefront in our minds, the underlying basis of which is that we ought to graduate the fistulous channel which feeds the overlying conjunctival pad in such a way as to ensure a sufficient escape of fluid, and no more, from the interior of the eye to the exterior. If the escape of fluid is too free we get hypotonus, if it is too scanty we get a recurrence of hypertonus. Once again, if we fistulize an eye which is in a condition of simple chronic glaucoma, and if we operate aseptically, we can rely with considerable confidence on the fistula remaining indefinitely of undiminished caliber. On the other hand, if the glaucoma is of chronic congestive or of a subacute or acute variety, we have not quite the same confidence, and we are therefore disposed to make our fistula larger than we otherwise should, with a view to making allowance for a certain and maybe a very appreciable diminution of its powers as an aqueduct. On the strength of such ideas as these the advocates of the leading sclerectomy operations have laid down modifications of their technique to meet the needs of various cases.

The trouble is that the problem is nothing like so simple as it might at first sight appear to be. Take trephining for example as an instance of an operative procedure in which the amount of sclero-corneal tunic removed can be very accurately gauged. We do not find that even in apparently the same class of case the removal of the same amount of a 2mm disk can be relied on to bring about the same amount of fall in ocular pressure. In one case the operation is followed by considerable hypotonus; in another by a pressure which is little different from the normal, and in a third by a distinct hypertonus, which, however, yields readily to massage. Again, the tendency of all trephined eyes is to show more marked hypotonus in the early stages than at a later period; in other

words the pressure tends to rise somewhat as the condition following the wound settles down. This is not surprising, for the large flap raised at the time of operation must be very loosely attached to the sclera at first, and must gradually re-acquire fresh attachments to it as the wound heals. If you will use a corneal microscope and a Gullstrand slit-lamp, you will see the development of these adhesions in progress, to some extent at least. Even without such aids, the employment of a good loupe will show you the progressive settling down of the scar and the diminution at the same time of the clearness with which the sclero-corneal opening can be seen.

There seems to me to be another factor in these cases, and one which I venture to think is intimately connected with the relative rates of secretion and excretion of the intraocular fluid. I am led to make this suggestion as a result of the observation of a number of cases in which, whilst the anatomic conditions of the fistula have not appeared to alter materially, the eye has passed from a state of marked hypotonus to one either normal or but little below the normal in tension. There can be but little doubt that a compensatory mechanism is at work in the interests of the eye and on the side of the surgeon. It seems not unlikely that the intraocular blood pressure, the vasomotor control of the eye, and the activity of secretion of the ocular fluid may one and all play a part in the process.

Devices to Increase the Efficiency of the Filtering Scar. A certain number of surgeons, dissatisfied with the filtering area they have obtained by trephining, or other means, have suggested the use of silk threads or of metal drains to be inserted under the flap in the neighborhood of the opening of the fistula or actually into the orifice of the latter. Their object seems to be a two-fold one (1) to keep the fistula open and (2) to spread the drainage of the escaping fluid evenly under the flap. In my opinion such ideas are founded on a misconception of the elementary facts that concern the drainage of the eye. To me they seem to be wrong in theory and mischievous in practice: Any surgeon with a wide knowledge of drainage operations must have learned that the essentials of successful fistulization are (1) to provide a wide conjunctival flap, (2) to make that flap as thick as possible, (3) to remove a portion of the whole thickness of the sclero-corneal tunic, (4) to prevent

plugging by the uveal membrane and (5) to ensure asepsis throughout. If these conditions can be fulfilled, satisfactory filtration can be relied on in every case. Failures are due to our inability invariably to satisfy these conditions. As the wide thick flap settles down into its place the best form of filtration follows automatically. Neither threads nor metal drains are needed to direct it. Nor can I conceive how the placing of the end of a silk suture, or of the bent toe of a metal drain into the fistula can be expected to keep it open. I can easily imagine that such devices might lead to fibrous tissue formations and so tend to close the fistula, even if it is itself aseptic. I can also readily conceive one of these drains as being a source of subdued sepsis and indeed we have reason to believe that such they have sometimes proved. I would most strongly urge you by whatever method you choose to do your sclerectomy, to put your trust in clean, skilful operating and rigid asepsis, and not to allow yourselves to be drawn into the employment of methods which are not founded on sound pathology, and which I believe to be mischievous in practice.

The Deliberate Inclusion of Iris in the Scar. Various methods of attaining this object have been advocated by a number of very distinguished surgeons. To discuss the subject at length would be beyond the scope or the possible limits of the present paper. To my mind these procedures are utterly wrong in principle. Those of you who have followed what I have said under the previous heading, will realize that such a measure as this contravenes what I regard as one of the first principles in connection with the establishment of a filtering scar. Apart altogether from this somewhat negative aspect of the case, there is another side to the question which we must not lose sight of. We have been taught from our student days to dread iris-inclusions in a wound. This dread has been founded, and justly founded, on sound, pathological work, and I regret more than I can possibly express the tendency on the part of able and honored colleagues to resort to a method which seems to me to stand self-condemned at the bar of modern pathology or of modern surgery. Believe me that I speak with the utmost reluctance on this subject, and that I would much prefer to pass it by untouched; but I feel that to

do so, in the face of the strong convictions I hold, would be cowardly and wrong.

(3) *The Safety of the Filtering Scar.* It is obvious that any of the factors which we have already discussed as making for the permanency and efficiency of a filtering scar must add to its safety from the ordinary point of view, but a special significance has been given to the word "safety" in this connection on account of the attention which has been focused of recent years on the danger of "late infection." Two quite different methods have been suggested for the avoidance of this serious complication, (1) the production of a filtering as distinguished from a fistulous scar, and (2) careful attention to the method of preparing the overlying flap. We shall take these in turn.

(1) *The Filtering as Opposed to the Fistulous Scar.* The work of Holth, Lagrange, Verhoeff, the writer, and others has established the existence of a fistulous scar as an indisputable, anatomical fact. The outer opening of the fistula may be, and indeed often is, hidden, by the opacification of the overlying tissues as years pass by; this in no way interferes with the freedom and the efficiency of the fistulization. Holth, the pioneer in the histological examination of fistulous scars, has done more of such work than all the rest of us put together, and his dictum is therefore of no little interest. He says, "after iridencleisis, as well as after sclerectomies, a real fistula through the limbal sclera is seen several years after the operations, if successful." This is a robust statement, founded on anatomical work, and contrasting strongly with Herbert's oft-repeated, but to the author's mind mistaken, conception of a spongy filtering, as distinct from a fistulous scar. Herbert would postulate as the surgeon's desideratum, a sclerectomy or sclerotomy aperture "fully occupied by new fibrocellular tissue." He describes a filtering scar admittedly in the process of contraction, and considers the stage in which he thus encountered it as illustrative of "the final condition of the scars, which are found clinically to filter permanently and satisfactorily." Apart altogether from the fact that such a conception is diametrically opposed to all that pathology has taught us of the behavior of fibrocellular tissue, the important point remains that no anatomical evidence of such a form of scar has ever yet been brought forward, as

the end-result of a glaucoma operation which has proved clinically successful. It is both interesting and encouraging to find Holth, the pioneer and the greatest exponent of this line of work, expressing himself in such unhesitating terms as those quoted above; for, be it noted, this is no academic discussion, but a matter on which the soundness or otherwise of our future lines of operative treatment depend. If the surgeon sees clearly that it is a fistula that he desires, and a fistula that he must have, he will bend all his energies to the attainment of his object under the best possible conditions, and will also be prepared to take certain risks, if necessary, in so doing. If, on the other hand, he allows himself to be misled by the idea that he can relieve his patient by some less drastic procedure, then there is a fear, and more than a fear, that he will be lacking in aim and uncertain in purpose. This is no plea for one form of operation rather than another; it is an appeal to first principles, which we cannot violate without injury to the heritage we are to hand down to posterity. It is for this reason that so much emphasis has been here laid on the subject.

My strong personal conviction is that, if we are to obtain efficient filtration in glaucoma cases, we must aim at fistulization, and that it would be futile to dissipate our strength by efforts to produce a type of scar of which after so many years there is absolutely no anatomical evidence, and the very conception of whose existence is repugnant to what we know of the elementary laws of the behavior of fibrocellular tissue.

(2) *The Method of Fashioning the Flap of a Filtration Scar.* The varying experiences of different surgeons as a result of the employment of presumably the same method of treatment, operative or otherwise, must always furnish a vast amount of material for thought. The conclusions to be drawn will vary widely in different cases. Not the least interesting of the modern chapters of the kind might be written around the incidence of late infection after trephining and other similar procedures. Some operators have had an extraordinarily unfortunate experience, their percentage of disaster being little short of appalling, whilst others, and they too men of large experience, great clinical knowledge, and undoubtedly honesty, have little or no personal acquaintance with this

dreaded sequel of sclerectomy. It would be difficult to escape the obvious conclusions that very much indeed depends on the technique of the individual operator. I am the more inclined to believe that this is the case owing to the fact that I have met with a number of surgeons who believe that they are doing my operation, whereas they have obviously evolved a technique of their own which differs in essential respects from the one which I have described at length and which I hold gives a strong guarantee of safety against late infection.

Let me here turn aside, at the risk of some slight repetition to state what I believe to be certain elementary truths: (A) A filtering scar to be efficient must depend upon an actual fistula, which places the fluids of the eye in comparatively free communication with the subconjunctival tissue. (B) A fistulous scar, whilst it places the interior of the eye in communication with the subconjunctival tissue, must necessarily involve a certain, even if small, element of risk to the contents of the globe whenever dangerous pathogenic organisms find a resting place, whether for a longer or shorter period, in the conjunctival sac. (C) The moment that the closure of the fistula removes this danger of infection of the interior of the eye from without, the scar ceases to filter and the operation has ended in failure. (D) The best method of protecting the eye from infection through the fistula lies in the careful fashioning of the overlying flap. This last point deserves careful discussion, if only on account of the large amount of misunderstanding which still appears to ensheathe it.

The flap that is to cover a filtration scar should be as thick as possible, taking up every available scrap of tissue right down to the sclera; it should also be cleanly dissected with a minimum of trauma; it should be as wide as possible to allow of free filtration, and with the same end in view, it should run concentric with the cornea, provision being thus made for the escape of fluid from the flap into the whole area of the subconjunctival tissue.

The ideal filtering scar should be but slightly raised above the level of the surrounding conjunctiva, sloping off into the latter on all sides, and presenting a flat table-land appearance. It should not be sharply raised, bullous, or vesicular. It is true that, even with careful operating, vesicular scars may

still sometimes be met with, but such occasions should be rare. Even in the thin conjunctivæ of old people it is possible to get beautiful flat filtering scars. It is sometimes suggested—probably by surgeons who have little practical acquaintance with the method—that trephined scars are usually vesicular. Such a statement is a ridiculous travesty of the facts. I see at intervals a large number of my old trephined cases, and am able to demonstrate to visitors and others the large percentage of cases in which ideal flat filtering scars are obtained. Vesicular scars are the exception. The same is true of the experience of a large number of other surgeons.

The Disadvantages of the Vesicular Scar. (1) A bulging scar may be a source of constant discomfort to a patient; in rare cases it may catch on the edge of the lid. On one occasion, when I was examining such a case in which the wall was very thin, the patient made a sudden violent movement, caught the vesicle on the lid edge, and burst it with an audible click. Fluid escaped through the fistula thus formed for some months afterwards and the patient asserts that she was never so comfortable as during that period. (2) Even when there is no discomfort, patients are sometimes alarmed or dissatisfied owing to the scar showing a bulge through the upper lid. (3) The surface of a vesicular scar may become abraded on its covering epithelium and may weep steadily. It has been pointed out that where transudation on a free scale can occur from within, there is always the possibility of infection from without. This interesting subject is nothing like so simple as some writers appear to think. A markedly vesicular scar may present no abrasions (by the fluorescein test) and may not transude fluid, at least to an extent that it is possible to appreciate. On the other hand, a wide, flat scar may, for a time at least, transude fluid abundantly, making the conjunctival sac uncomfortably moist despite the fact that the surface epithelium is intact.

I am not at all inclined to dispute that a filtration scar whose surface epithelium is abraded may be a source of danger to an eye; but I am astonished that any one should regard such a condition as the end-result of an operative procedure of any kind. I regard such a condition as calling for continued active treatment, and do not rest satisfied until the epithelium sur-

face is once again intact. Zinc sulphate, silver collosol, silver nitrate, and other drugs are of the greatest value in the treatment of such cases.

Nor should I be content to stand idly by whilst a patient complained of excess of moisture as a result of transudation even through a healthily covered flap; treatment with zinc salts and with other drugs, tried in turn if one fails, will soon lessen the discomfort the patient is experiencing. Even the marked bulging of a vesicular scar, objected to for cosmetic reasons or on account of discomfort, may be markedly reduced by steady painting of its surface at intervals of four or five days with a solution of a silver nitrate (grs. v to x to the oz.)

Holth and others appear to have assumed that a weeping vesicular scar is a common occurrence after trephining. If it is so in any surgeon's practice, all I can say is that the technique employed must be defective. I have used fluorescein on a large number of trephined scars, both shortly after operation and months or years afterwards. Even so soon as one week after a trephining, one usually gets no staining of the surface, if the typical, flat, healthy scar is obtained. Sometimes for a few days afterwards, there will be slight staining at the limbus; the use of zinc sulphate drops will usually soon remedy this; if it does not, silver nitrate drops (gr. iii to oz. i) should be tried after the previous instillation of cocaine. It is rarely necessary to use anything stronger. Indeed silver collosol alone will often suffice.

A FEW SUBSIDIARY POINTS REMAIN TO BE CONSIDERED:

Shrinking of the Caliber of the Fistula. A scar that has filtered well for three months may practically be relied on to last indefinitely. Very rarely one sees the freedom of filtration lessen as the years go by and I have under my care one patient in whom a second trephining was called for some years after the first. It is just possible that the explanation of such cases is that the fistula has become blocked owing to the proliferation of connective tissue from its walls, as the result of trauma inflicted at the time of the operation. For what it is worth this is an argument in favor of using sharp instruments during the sclerectomy with a view to obtaining a clean-cut

fistula. It has been suggested that this can be better done with the scissors in the Lagrange or Holth operation, and with the trephine in my own. Such a suggestion is, I hold, utterly unfounded on fact. A really sharp trephine blade has an edge almost like a razor. I would ask any of you who doubt this to take one of the disks cut out by a sharp trephine—a blunt trephine should never be used under any circumstances—and examine it while it is still fresh under a microscope. With regard to the final cut with scissors made when it is desired to remove a part only of the trephined disk, this is obviously just as clean as that of the Lagrange or Holth operation. I merely mention these facts in order to controvert erroneous and ill-founded statements which have been made on the subject.

The Formation of Secondary Fistulae in the Neighborhood of a Trephine Hole. This phenomenon has been noticed by several observers beside myself. I believe many of you will observe it, if you look for it. It is not rare. The most probable explanation of it appears to me to be that the new channel follows the line of a vessel perforating the sclera in the neighborhood of the fistula.

REFERENCES.

- ELLIOT, R. H. *Brit. Journ. Ophthal.*, 1921, vol. v., pp. 91 and 237.
ELLIOT, R. H. "Demonstration of a permanently Filtering Trephined Scar." *Oxford Ophthal. Congress*, July, 1917; and "A Treatise on Glaucoma," *Oxford Medical Pub.*, London, 1922.
ELLIOT, R. H. "Histology of the Trephined Disk." *Trans. O. S. of U. K.*, 1918, vol. xxxviii.
HERBERT, H. *Ibid.*, 1920, vol. iv., p. 553, and 1921, vol. v., p. 183.
HOLTH, S. "The Anatomy of Successful Glaucoma Operation." *Bericht der Ophthal. Gesell.*, Heidelberg, 1913, p. 355, and *The Ophthalmoscope*, 1914, p. 347.
HOLTH, S. *Brit. Jour. Ophth.*, 1922, pp. 10-22.
VERHOEFF, F. H. "Histological Findings after Successful Sclerostomy." *Arch. Ophth.*, March, 1915, vol. xliv., No. 2; and *The Ophthalmoscope*, 1915, vol. xiii., p. 352.

PHAKCERISIS.¹

THE ADVANTAGES AND IMPORTANT DETAILS OF TECHNIQUE.

BY PROF. IGNACIO BARRAQUER, BARCELONA.

WHAT would we say of the surgeon who, in order to extirpate an intraperitoneal cyst, should split its capsule and spill the contents into the serous cavity and then by means of pressure, instruments or by washing, etc., clean the peritoneal folds of the remains of the lesion, leaving necessarily a great quantity of them and the cystic membrane behind? How many patients would suffer from peritonitis! What a large percentage of calamities due to the imperfection of the procedure would result!

Well, then! In practicing a cataract extraction with cystotomy we are doing nothing more than intervening as imperfectly as that, since the chambers of the eye are a serous cavity and the opaque lens represents a cyst, whose contents spilling into the cavity cause inflammation and reactions on the part of the intraocular tissues, opening the field to infection. The cystic capsular membrane, when it is not imprisoned in the lips of the wound, causes ultimate complications and forms a secondary cataract in most cases, which lowers the sight and obliges one to intervene anew. It is then necessary for the ophthalmologist, if he desires to follow the elementary rules of the surgeon, to give up cystotomy entirely. All modifications conceived for the operation of cataract tend to dispose of with a minimum maneuver, the greatest possible quantity of the remains of the lesion, and in practicing a cystotomy we all try to perform the most com-

¹ Read before the Section on Ophthalmology, New York Academy of Medicine, April, 1922.

plete toilet of the wound possible. We desire to approach a total extraction, convinced that this is the ideal one. If the latter has not been generally done, it is through a lack of procedure free from dangers which I shall not enumerate in order not to exceed the limits of this communication. For more than six years I performed hundreds of total extractions by means of the lens extractor. On each day by my statistics I saw the number of accidents and complications decrease proportionally to increasing the number of aphakics with normal visual acuity. My manner of procedure is as follows:

1. Dilatation of the pupil by means of an ointment of chloride of euphthalmine and cocaine 5%.
2. Temporary paralysis of the orbicularis muscle by injection of novocaine 1%.
3. By fashioning an incision in the upper $\frac{2}{3}$ of the cornea with a scleral-conjunctival flap.
4. Application of a suture to the conjunctival flap which will be tied after ending the operation, assuring complete coaptation of the lips of the incision.
5. With Hess's forceps to make a peripheral iridectomy as far as possible from the sphincter.
6. Adaptation of the cup to the anterior surface of the lens.
7. Dislocation of the lens from the patellar fossa.
8. Extraction.
9. Toilet.
10. Eserine and bandage.

The conditions indispensable to secure a perfect success are: The patient must have exactly the necessary dilatation of the pupil; because an excess of mydriasis makes a peripheral iridectomy difficult to perform; a pupil which is too small complicates extraction and exposes to traumatism of the iris, which always should be avoided. During the course of the operation not the least pressure is exerted upon the globe, because one ought always to use temporary paralysis of the orbicularis muscle; avoiding thus efforts that the patient can make by squeezing; not to use a speculum, and to have an assistant practiced in the suitable way of holding the lids, and giving special attention to not compressing the globe with the fixation forceps when making the incision. Any undue pressure or deformation of the globe causes rupture of the

hyaloid and predisposes to loss of vitreous. The extraction should be made quietly and gently without any pressure with the lens upon the patellar fossa, and dislocating it in such a way that its upper border follows from above down.

The intensity of vacuum which we employ with the cup should be exactly measured beforehand with reference to the physical condition of the cataract. In a senile cataract, hard and complete, one can use an intensity of vacuum equal to 60cc of mercury, exceptionally 65cc, and in partly hard cataracts, milky or half milky and incipient, the vacuum should be diminished in proportion to the hardness. An insufficient intensity does not rupture the zonule, but an excessive suction can rupture the capsule. Every accident from the operation is caused by lack of either surgical technique or foresight. One must be, for this operation, most careful and exact in all small details. An attempt to dilate the pupil ought to be made a few days before the operation, in order to determine the application of the mydriatic ointment, and ought to be done one or more days before operation, which time varies with the patient; and a minute examination of the cataract and zonule by means of the slit-lamp of Gullstrand and the corneal microscope of Zeiss, gives us a way of being acquainted with the physical condition of the cataract and through this the amount of vacuum to use is determined.

To repeat: 1. To perform a successful phakœrisis a previous careful study of the patient is necessary, since each one of the eyes to be operated on requires distinct technique.

2. Knowing how to regulate the lens extractor.
3. To avoid at all costs pressure on the globe.

One should not intervene in subjects under forty, because in them the zonule is still very resistant, nor in a complicated cataract or in one occurring in myopia, in a subluxated lens, in a traumatic cataract or in one ripened artificially by means of a preparatory iridectomy.

In all of the cases which have been done correctly and without accident, the first dressing after six or seven days, fails to excite the least hyperæmia, the pupil reacts perfectly and is pure black, and the patient enjoys full visual acuity.

THE DIAGNOSTIC USE OF THE UVEAL PIGMENT IN INJURIES OF THE UVEAL TRACT.¹

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In a former paper (1) by one of the authors, clinical and experimental studies on the immune reactions following injuries to the uveal tract were presented. These studies showed 1. In an intraocular injury involving the uveal tract where normal healing took place without the occurrence of a sympathetic disturbance in the fellow eye, there developed in the blood serum a positive complement fixation reaction to an antigen made from the pigment of the uveal tract. 2. In the cases of the intraocular injury involving the uveal tract when normal healing was delayed, and where sympathetic disturbance in the second eye sometimes occurred, this complement fixation reaction to pigment antigen was absent. Furthermore, there was not only the absence of this complement fixation reaction, but in one case of sympathetic disturbance, there appeared to be a definite hypersensitivity to pigment. Evidence was also presented which led the author to believe that the occurrence of this complement fixation reaction was evidence of the development of an immunity by the organism to the pigment, and gave definite protection against the outbreak of a sympathetic disturbance in the fellow eye. Further, it seemed clear that the failure to develop this complement fixation reaction was evidence of the failure to develop an immunity, and was so attended by a persistence of in-

¹ Presented before the American Ophthalmological Society at Washington, May 3, 1922.

flammatory symptoms and the liability to the development of a sympathetic disturbance in the fellow eye.

The possible clinical use of this phenomenon for the purpose of early information as to the prognosis, in any given case of intraocular injury involving the uveal tract, is at once evident. Should these facts hold true, the development in the blood serum of a positive complement fixation against pigment antigen, would warrant the surgeon in giving a favorable prognosis, and allow him to leave the injured eye without fear of the development of a sympathetic disturbance in the fellow eye. On the other hand, the failure to develop a positive reaction would give definite information to the surgeon that sympathetic ophthalmia was an event to be feared, and would allow removal of the injured eye before the outbreak of the sympathetic disease.

It is the purpose of this paper to report cases of intraocular trauma involving the uveal tract, in which this serum complement fixation reaction against uveal pigment was used as a diagnostic procedure to determine the status of the case as regards the possible outbreak of sympathetic ophthalmia.

THE DIAGNOSTIC USE OF UVEAL PIGMENT ANTIGEN IN THE SERUM COMPLEMENT FIXATION REACTION.

The serums from seventeen cases of intraocular injury involving the uveal tract, occurring in the private and dispensary practices were examined in the complement fixation reaction against an antigen of uveal pigment. The technique of the reactions and the preparation of the antigen have been previously reported.(2)

Grouping these cases according either to the results of the reaction, or the clinical picture and result, they fall into three rather general groups. The first group comprises ten cases which gave a positive complement fixation reaction, and which healed without the occurrence of any sympathetic disturbance. In three of these cases, however, for one or another reason enucleation was performed. The second group comprises three cases which all showed negative complement fixation reactions and at the same time showed more or less severe signs of a sympathetic disturbance. The third group

comprises three cases which showed alarming symptoms in the injured eye but without any manifestation of sympathetic disturbance in the second eye, and gave negative reactions.

GROUP I.

The following reports are of the cases in which following wounds of the uveal tract the blood serums showed positive complement fixation reaction against pigment antigen.

No. 1.—Struck in left eye April 16, 1921, by a piece of steel. Wound of entrance lower corneal margin. The splinter of steel passed back through the iris and was localized by X-ray, in the region of the lower ciliary processes. Size of splinter was 12×2 mm. Removed by magnet extraction April 17, 1921. Serum reaction against pigment antigen on May 2, 1921, was + + + and May 21, 1921 + + +. Injured eye gradually underwent phthisis. In March, 1922, injured eye was small, sightless, and not inflamed. Right eye held $\frac{1}{5}$ vision throughout and has remained free from trouble to date.

No. 2.—Struck in right eye by a flying piece of steel, June, 1921. Wound of entrance, cornea-scleral border. X-ray showed intraocular splinter of steel 13×3 mm. Successfully removed by magnet extraction on June 14, 1921. Serum reaction against pigment antigen on June 25, 1921 was + + +. Injured eye healed quickly and retained $\frac{1}{8}$ vision. Left eye held normal vision and has shown no subjective or objective signs of disturbance.

No. 3.—Struck in right eye on Sept. 14, 1921. A perforating wound of cornea with prolapse of iris and ciliary body resulted. Prolapsed tissue was abscised within three hours after accident, scleral suture and conjunctival flap were made. Uneventful healing, but a phthisical eye, resulted. Serum reaction on Oct. 1, 1921 was + + +. There was no disturbance of any type in left eye, but on Oct. 26, 1921 right eye was enucleated for cosmetic reasons.

No. 4.—Struck in right eye Dec. 14, 1921, breaking patient's spectacles. There was a perforating wound of right eye, involving cornea, iris, lens, and ciliary body. Prolapsed tissue was abscised after accident. Traumatic cataract developed and was removed.

The eye showed a continual cyclitis of varying intensity

which finally, starting about the middle of February, gradually subsided with a retention of $\frac{2}{3}$ vision, with correction.

The following were the serum reactions in this case:—
 Dec. 14, 1921, = ±; Jan. 9, 1922, = + +; Jan. 21, 1922,
 = negative. Feb. 13, 1922, = + + +; March 27, 1922
 = + + +.

Vision in the uninjured eye was $\frac{2}{3}$ at the time of the accident. There has at no time been any failure of the visual acuity or field or disturbance of any kind.

This case is of especial interest in that recovery was delayed, and with this delay, the patient passed from a positive phase to a negative phase and finally to a second positive phase which has been steadily maintained.

No. 5.—November, 1921, while hunting, was struck in right eye with spent shot. Treated at home.

Exam.: X-ray: bullet down and in. Iridocyclitis and detached retina below.

Treatment: Enucleation. 12-11-21.

12-20-21. Discharged. Normal recovery.

12-11-21. Serum reaction against uveal pigment + +.

No. 6.—Nov. 15, 1921. Struck in left eye with piece of glass.

Exam.: "X" shaped penetrating wound in temp. side over region of ciliary body, the wound being 4-6 mm long (Nov. 16, 1921.)

Treatment: Scleral wound sutured—conjunctival flap.

Course: Looked very well for first ten days then eye became red—ciliary congestion—iris showed greenish discoloration—Vit. exudate. T—

12-9-21. Enucleation.

12-16-21 Discharged. Right eye normal.

Dec. 15, 1921. Serum Reaction against uveal pigment. ±

No. 7.—Dec. 21, 1921, while playing with knife it struck him in the eye.

Exam.: Perf. wound of cornea starting a few mm above limbus at 12 o'clock and running downwards for about 8 mm. Iris cut above. Some vitreous in upper part of wound. Lens swollen.

Treatment: 12-28-21. Adm. to hospital.

12-28-21. Wound cleaned up and some of cataractous lens let out.

Course: 1-6-22. Serum reaction against uveal pigment negative, no immunity.

2-4-22. Serum reaction against uveal pigment + + +.

2-17-22. Discharged. Ran through a long drawn out iridocyclitis with remissions and relapses. On exit left

eye nearly white. Considerable cortex remaining. Capsule adherent to cornea and iris to capsule. V. R. $\frac{2}{3}$ L.HM.

3-20-22. Iridectomy.

4-15-22. Discharged. Normal recovery.

No. 8.—1-19-22. While on street was struck by some unknown object in right eye.

Exam.: Linear incision through cornea from 9 to 5 o'clock and extending into C.B. Iris prolapsing, also part of C.B. and some vitreous. V. = P.L.

Treatment: Prolapsing iris C.B. and vitreous abscised. Wound closed with scleral and conjunctival flap.

Course: Made normal recovery. Discharged 2-7-22. Vision $\frac{2}{5}$. When last seen in clinic V. $\frac{3}{5}$ +. Eye was white. No pain, left eye normal V. $\frac{3}{5}$.

Serum reactions against uveal pigment:

2-1-22. Negative.

2-13-22. Anti-complementary.

2-28-22 +

No. 9.—Sept. 1921 struck in right eye with splinter of steel. Three weeks ago noticed right pupil larger than left.

Exam.: Corneal scar lower nasal quadrant with laceration of iris and opacity of lens directly behind. Imbedded in retina 3 disk diameters below disk there is an oblong foreign body surrounded by degenerated retina and choroid. Numerous small retinal exudates surrounding foreign body. V. $\frac{2}{5}$.

Treatment: Giant magnet extract through zonule and A. C.

Course: 2-11-22. Serum reaction against uveal pigment +

2-17-22. Vitreous hazy. Some oedema and cloudiness about old choroidal scar.

2-25-22. Discharged. V. 20-70. Eye white. Vit. clearer. Fundus unchanged.

3-16-22. Readmitted. Detachment of retina below. V. R. $\frac{1}{6}$; L. $\frac{2}{5}$.

Left eye normal.

No. 10.—Jan. 2, 1922, left eye injured by wire in coasting. Prolapsed iris abscised. Eye has remained red. Shrunken. No pain.

Seen on Feb. 6, 1922. Ciliary congestion. Iris discolored. Scar in cornea on temporal periphery. Somewhat indrawn. Beginning phthisis, faulty projection.

Serum reaction Feb. 13, 1922: + + +.

No. 11.¹—Feb. 2, 1922. Was struck in right eye by nail. He withdrew nail following accident.

Exam.: V. HM. Perforating wound of cornea in lower nasal quadrant. Iris cut and caught in wound. Lens cataractous. P. L. good.

Treatment: 2-6-22. Wound freed of iris.

Course: 2-14-22. Anterior synech. at site of injury some exudate back of lens. Eye very red.

2-25-22. Serum reaction—negative. No immunity.

3-15-22. Discharged. Eye still very red. T. N.; V. $\frac{1}{200}$; L. proj. N.; lens subluxated and cataractous.

4-18-22. Eye still red. No pain. T. N.: V. HM. L. eye normal.

GROUP II.

The following reports are of cases in which the following injuries of the uveal tract, the blood serum showed negative complement fixation reactions. These cases showed either at the time of serum reactions, or developing later, disturbances in the second eye which were believed to be sympathetic in nature.

No. 12.—Shot in head Aug. 30, 1921, with a shotgun. Many shot penetrated skull and one shot penetrated left eye, passing through eyeball and lodging near nasal wall of orbit. Craniotomy was performed Sept. 3, 1921, with removal of many shot. Iridectomy was performed on left eye on Sept. 9, 1921, for removal of iris tissue incarcerated in wound of entrance. Serum reaction on Sept. 8, 1921, was negative. Serum reaction on Sept. 30 was still negative. The eye was still inflamed, and sightless. Enucleation was advised and refused. The child returned to his home in Virginia on Oct. 1, 1921. On Oct. 7th an attack of photophobia with pericorneal flushing in the right eye was reported by the local physician. The child was brought back to Baltimore on Oct. 14, 1921. At that time there was still decided photophobia but the eye was otherwise objectively negative. Serum reaction on Oct. 14, 1921, was negative. Enucleation of left eye was performed on Oct. 16, 1921. Following enucleation, the photophobia of the right eye disappeared, and the eye has remained entirely normal since then.

No. 13.—Penetrating wound, left eye, 1909. Normal healing with retention of $\frac{1}{6}$ vision. In May, 1921, some

¹ (Case incomplete—no serum reaction has been done since negative reaction of Feb. 25th. Case is still under observation, and is included in this series, insomuch as the report includes all cases tested up to March 15, 1922.)

solder flew up in left eye causing great pain which steadily persisted. Right vision began to fail in July, 1921. On examination Aug. 23, 1921, the left eye showed a displaced pupil, back of which, bulging the iris forward, a foreign body could be distinctly seen. There was a low grade cyclitis, tension was normal, vision $\frac{2}{3}$. The right eye showed nothing objectively except marked vascular congestion of the fundus and slight photophobia. Vision was $\frac{3}{8}$ —with correction. Visual fields showed normal field in right eye and concentric contraction in left. A complete medical study at Johns Hopkins Hospital showed only negative results. Laryngological and all other special examinations were likewise negative. On Aug. 26, 1921, the serum reaction with pigment antigen was negative. A tentative diagnosis of sympathetic irritation in the right eye was made and enucleation of left eye advised. The patient returned to his home in North Carolina where enucleation was performed, and patient reported that following enucleation all symptoms in right eye cleared.

No. 14.¹—Boy aged 8 years. Patient was seen first Sept. 10, 1921, at which time right eye showed an unhealed corneal ulcer with prolapse of iris in a dense scar in lower half of right cornea. Condition appeared to be the result of a gonorrhreal ophthalmia, which had begun 3 months previous. V. = L. P. Tension +. Sept. 13th operation, iridectomy upward, defect in cornea curetted, prolapsed iris removed and conjunctival flap made. Uneventful healing. Patient was discharged on Sept. 27th. R. V. $\frac{2}{3}0$, L. V. $\frac{4}{8}$ Oct. 31st. Patient returned with ciliary congestion of left eye, posterior corneal deposits and posterior synechiae. The injured (right) eye showed corneal defect covered by conjunctival flap, and low tension. Special examinations were negative except for some evidence of intestinal fermentation. All treatment, including colon irrigations, etc., were without results. Nov. 9th. Right eye was enucleated. This was without effect on the left eye which ran a typical course of sympathetic ophthalmia,—nodules in the iris, peripheric retraction of iris, complete posterior synechiae, capsular opacity of lens, elevated tension.

Serum reaction: Dec. 21, 1921, completely negative.

GROUP III.

The following reports are of three cases in which the serum reaction was negative and in which the injured eyes were enucleated as a precautionary measure.

¹ This case was later treated with uveal pigment as a therapeutic procedure. Full details will be reported.

No. 15.—Struck in left eye with a bit of steel Dec. 12, 1921, penetrating wound through ciliary body with intraocular retention of piece of steel. Removed by magnet extraction on the same day. Eye was sightless, and showed continual low grade cyclitis with periodic violent relapses. All medical examinations were negative. Radiograph showed no further intraocular foreign body. Jan. 17, 1921, and Feb. 15, 1921, the serum reactions against pigment antigen were negative. Left eye was enucleated on Feb. 21, 1921. Right eye was normal.

No. 16.—Nov. 1911 was struck by tree branch causing perforating injury for which he has been treated in his home town until Jan. 13, 1922.

Exam.: Marked pericorneal congestion. Perforating corneal wound just below center. Iris greenish and adherent to wound. Pupil occluded. P. L. good. V. L. $\frac{1}{2}$.

Treatment: Enucleation with fat implantation, 1-14-22.

Course: 1-26-22. Discharged. Normal recovery. V. L. $\frac{1}{2}$. Serum reaction against uveal pigment, 1-20-22: negative.

No. 17.—Shot in right eye with B.B. shot May 14, 1921. Shot penetrated glove through upper lid and sclera above cornea.

Treatment: Adm. to Hospital and discharged as soon as haemophthalmos had cleared up (6-9-21).

Course: Came to clinic for observation. Had several intraocular hemorrhages. T. gradually became soft and the eye remained red. Light projection faulty.

1-6-22. Serum reaction against uveal pigment. Negative.

1-10-22. Adm. to Hospital. Enucleation. Shot found outside globe but adherent to it near optic nerve.

When last seen 4-18-22. Left eye normal, V. $\frac{1}{2}$.

There were two other cases in which the serum reactions were negative, but these cases are of academic interest only. They were both cases of old sympathetic ophthalmia which had finally subsided following enucleation of the exciting eye. One case followed subconjunctival scleral rupture and showed a sympathetic ophthalmia in the second eye which gradually recovered following enucleation of the injured eye. It is of interest that this patient showed a positive intradermal tuberculin reaction, confusing the diagnosis. The second case was one of delayed sympathetic ophthalmia

in the left eye, following a bayonet wound of the right eye. When seen one year later the left eye was nearly sightless. The right had been enucleated at the time of the sympathetic disturbance in the left eye.

COMMENT.

In these cases above reported, it is frankly admitted that the presence or absence of a positive complement fixation reaction was not the sole index which governed the decision as to whether or not an injured eye should be left or enucleated. In two cases enucleation was performed before the blood was taken for the serum reaction, which in both cases was found positive. In other cases the presence of a positive serum reaction lead to the temporary postponement of enucleation, which was later permanently abandoned on account of the favorable outcome of the case. Yet an analysis of those cases which gave positive results, excluding the two cases in which the picture is confused owing to enucleation having been performed prior to the discovery of a positive blood, shows a rather significant fact. Had we relied, in these cases, upon a positive serum reaction as the index of when not to remove an injured eye, our faith would have been justified. In other words, the occurrence of a positive serum reaction, irrespective of the condition of the injured eye at the time the reaction was done, was always followed in time by a subsidence of inflammation without any manifestation of sympathetic disturbance.

Whether the opposite of this is true—that a negative reaction is sufficient indication to remove an injured eye for fear of a possible sympathetic ophthalmia—is not so clear. Of the seven cases which showed negative reactions, one is still under observation and three, at the time of the serum test, already showed signs of a sympathetic disturbance. In the remaining three cases, we did not wait for a possible sympathetic disturbance to develop—the injured eyes were enucleated. But these three cases all showed a long-standing, chronic cyclitis, the eyes clinically appearing dangerous. So in all three enucleation was justified by the clinical symptoms alone.

In the absolute interpretation of negative results, other factors must be considered. In the first place the blood serum practically never becomes positive before ten days after the injury, and frequently never becomes positive before four weeks. Furthermore, as is illustrated by case No. 4, Group 1, the patient may go from a positive phase to a negative phase, and then finally to a positive phase. If a single, or two, negative reactions were taken as a definite indication for the removal of an injured eye, eyes might so be needlessly removed, for in a few weeks more it is possible that the patient might go into a permanent positive phase, and be automatically protected against sympathetic ophthalmia. Therefore, if the serum reaction is negative, the time interval after injury must be first considered. However, if six weeks after injury the patient has failed to develop a positive reaction, it seems unlikely, from the information we now have, that a positive reaction will ultimately develop. In such cases the possibility of sympathetic ophthalmia and enucleation of the injured eye should be carefully considered.

There is one further point to be considered in the interpretation of positive results. That point is this:—Is the immunity indicated by a positive reaction permanent, or is the immunity likely to fail and the patient later becomes susceptible to sympathetic ophthalmia? This question is very difficult to answer. We have seen one, and only one, case go from an initial positive phase to a negative phase, and this patient later, within three weeks after entering the negative phase, again became positive, and has so remained. An immunological fact is known which may be somewhat analogous to this reaction. In an animal experimentally immunized by repeated injections of foreign protein, each fresh injection is followed by a temporary decrease in the anti-body titer. If the original titer is not very high this decrease may throw the animal from a positive to a negative phase. This reaction is followed, however, by a further increase over the original titer, so the animal soon again becomes more positive than before.

Every other case examined which showed a positive reaction, so far as our work has gone, has remained positive. Yet the following fact is true. In the earlier work in man with

this complement fixation reaction, most of the cases tested were cases where the traumatism was one year or more old, and it must be admitted that positive reactions in these cases were weaker than in the more recent cases. From a review of the work previously reported, it seems clear that immunity, once definitely established, will last from two to three years, and probably much longer, but gradually will become weaker.

Summarizing the results shown by the cases here reported, which showed positive reactions, considered in the light of our previous studies, it seems probable that a positive reaction indicates a definite immunity to the development of sympathetic ophthalmia and that this immunity will last at least several years, if not permanently. From these findings it seems, then, that with the occurrence of a positive serum reaction, unless the clinical condition clearly contraindicated such a course—that the surgeon is warranted in not enucleating injured eyes.

SUMMARY.

The immune reactions which follow intraocular injuries involving the uveal tract of the eye were used in seventeen such cases as a diagnostic procedure. In ten cases the complement fixation reaction was positive. These cases showed a normal healing without the occurrence of any sympathetic disturbance. One case is still incomplete. Three cases showed negative reactions, and of these one showed clinically a malignant sympathetic ophthalmia, and two showed definite signs of sympathetic irritation. The three remaining cases showed negative reactions, and in these cases the injured eyes were enucleated as a precautionary measure. The other cases of old sympathetic ophthalmia showed negative reactions.

BIBLIOGRAPHY.

1. Woods, A. C. "Immune Reactions following Injuries to the Uveal Tract," *Journal of A. M. A.*, 1921-77, 1317-1322.
2. Woods, A. C. "Ocular Anaphylaxis IV. The Antigenic Properties of Uveal Tissue as shown by Complement Fixation," *ARCH. OPHTH.*, 1917, 46-503.

ROENTGEN RAY STUDIES OF THE NASOLACRIMAL PASSAGEWAYS.¹

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(*With three illustrations on Text-Plate XIX.*)

THE purpose of this paper may be given under four headings:

1. To give a short outline of the various methods used in treating stenosis and infection of the nasolacrimal passageways.
2. And chiefly, to give in detail a method for examining these passageways by means of the roentgen ray.
3. To present certain data which have accumulated in the course of our X-ray studies of some sixty cases in the past year.
4. For the sake of completeness, a preliminary report is given of 10 cases with complete obstructions that have been operated during this period.

Permanent relief of infections and of stenosis of the nasolacrimal passageways, with their attending complications, is a problem of first importance to the oculist and the rhinologist. A patient seldom brings a more annoying or troublesome complaint to his physician than the constant drainage of tears over the lid margins. In fact, few things can be more disconcerting or disconcerting than a "watery eye." Constant tearing makes reading a hardship and the doing of close work next to impossible. Also, the poor drainage for the tears predisposes to the growth of bacteria about the eye and to abscess formation in the lacrimal sac. This last condition is a constant source of danger to the integrity of the eye. If a "watery eye" is troublesome, then a "pusy eye" must be next to intolerable, and we find that our patient will go to almost

¹ Read before the Wayne County Medical Society, January 23, 1922.

any extreme to obtain relief. How can this best be accomplished?

Methods of treatment advocated and some of the objections offered to the various procedures may be divided into three groups.

First group: Those which seek to correct the stenosis by introducing instruments (such as probes) through the canaliculi or by cutting and curetting the strictures.

Objections: These procedures are very painful and must be continued for a long period of time and for these reasons if for no other the percentage of failures will be high.

Second group: Those advocating the removal of the sac or its destruction by a caustic.

Objection: These procedures, although ridding the patient of the infection, do not provide for the drainage of the tears into the nose.

Third group: Those operations which attempt to drain the tears and to clear the abscessed or infected sac by establishing free drainage into the nose. The usual procedure here is to short-circuit the tears through the sac into the middle nasal meatus. West (1), who was one of the first to accomplish this by intranasal operation, made a large window in the lateral wall of the nose opposite the position occupied by the middle and upper third of the nasolacrimal duct.

The earlier operations were done, not by the intranasal route, but through an incision made in the skin over the sac. Toti (2) described such a procedure in 1904.

The chief causes for failure reported for both the external and intranasal methods are: (1) poor function in one of the puncta, usually due to slitting the lower one; (2) small sclerotic or obliterated sac; (3) failure of the new avenue of drainage to remain open, or to give proper drainage because of its having been placed in a wrong position.

It at once becomes apparent that if the operation could be approached knowing the exact location of the obstruction and size and condition of the sac, and if, after the operation, the size and exact location of the opening made on the inner wall of the lacrimal sac could be known, a step forward would be made in the effort to solve our problem. It was with these points in mind that the present work was undertaken. In the past

year we have made X-ray studies of some sixty normal, obstructed, and operated passageways. It is the chief object of this paper to indicate some of the practical significance of such data.

We would also emphasize the fact that, so far as our experience goes, there is no harmful effect associated with the procedure, either in its use in the normal or in the obstructed passageways. It is only fair to add that the injections to be described soon in this paper, should be made by one who is familiar with the technique of syringing the lacrimal apparatus and that care should be taken not to make our injections subcutaneous.

Method of Bismuth Injection and X-raying.—The method of procedure has been first to undertake the usual routine of attempting to syringe solutions by way of the puncta through the sac and duct, into the nose. After this, the passageways are injected with oil and bismuth and X-rays taken in the lateral and in the postero-anterior position.

The following is the technique in detail. A few drops of 2% cocaine are dropped into the lower cul-de-sac. Any mucus or pus which may be in the sac is expressed by pressure. If desired, the puncta to be injected may be dilated slightly, but under no circumstances should the canaliculus be slit. The passages are then syringed out with a normal saline solution to which a few drops of 1:0000 epinephrine solution have been added. After this the passageways are injected with Beck's bismuth and oil paste. For this last we use an ordinary 2cc all-glass Luer syringe and No. 19 needle which has been filed blunt. In the progress of our work it has been found desirable in certain cases to obstruct the puncta, which is not being used in the bismuth injection. For this purpose a medium sized common pin is placed in the puncta selected. Less than 1cc will be required to inject the unobstructed passageways, while about $\frac{1}{2}$ cc will suffice in those with obstruction. In trying to locate the sac relative to the intranasal structures, we have found that the placing of a small silver rider over the anterior end of the middle turbinate just below its attachment to the lateral wall of the nose is of considerable value. Recently we have outlined the position of the entire anterior end of the middle turbinate by a stripe of bismuth which is easily applied, using

a long lacrimal needle. The lateral X-ray plate will then show how much of the unobstructed passage lies above or below the root of the turbinate, also whether it is in front or back of the turbinate. The marker has not been used in all our cases, but that it is a procedure of value has been clearly demonstrated.

Studies Made of the Passageways. The patients complain of little or no discomfort from the injection of the bismuth. We are in the habit of asking the patient to return in two days following the X-ray, at which time any bismuth which may remain in the passageways can be easily syringed out. Our experience has been that those cases without obstruction will, as a rule, show no bismuth, while those with obstruction will have more or less bismuth in the passages. In the study of the radiograph the two lacrimal canaliculi are seen as they pass from the free margin of the upper and lower lid, running at first vertically for a short distance and then turning at right angles to become directed medially in a convergent course toward the lacrimal sac. Into this they empty either separately or after having united to form a short common trunk. One or both of the canaliculi may be occluded either congenitally or as the result of inflammation and cicatrix. The X-ray is of value in showing just where and to what extent these small passageways have been involved. Next is noted the outline of the normal sac, the anterior-posterior diameter of which when injected is 5 to 10mm and the length of which is 12 to 16mm. Normally the nasolacrimal duct is a direct continuation of the sac with an end to end union. However, there may be a side to side joining; we have seen several such cases in this series. The average length of the duct is about 25mm and it has a diameter, when injected, of from 1 to 8mm. The narrowest portion of the duct is, as a rule, at its opening into the nose, and not at the junction with the sac as is usually stated.

In a diseased or obstructed sac we may have one of two extremes: First, the sac after prolonged obstruction may be greatly enlarged and dilated just as is seen in the gall-bladder with biliary stasis. Second, the sac may be very small as the result of repeated abscess formation and cicatrix, or it may show any of the intermediate forms. The largest sac we have

seen measured 22mm while many of the contracted ones measured less than 3mm in length. One of our cases showed a fistula leading into the soft tissues of the face, while another showed a fistula leading into the ethmoid labyrinth. Indeed, since these studies were undertaken, von Szily (3) has reported two cases of internal fistula of the lacrimal sac in which the X-ray was of value in making the diagnosis.

Besides those cases with complete obstruction, we see many cases with partial obstructions, complaining of tearing and even pus formation in the sac. The X-ray in this instance is of special value,—1st, because the site of the beginning obstruction is accurately located; 2d by the radiograph we are able to determine the anatomic type of the passageways. Is the duct regular in contour, or is its course angular and not suitable for probing? We have repeatedly noted, in the course of these studies, that the duct on one side may be regular in form and of a good size, while the duct draining the opposite eye may be grossly malformed and of a small lumen.

Variations and Anomalies of Genetic Origin.—Variations and anomalies in the nasolacrimal apparatus are usually readily explained by a consideration of the embryology of these passageways. Congenital absence of one or both puncta may be due to failure of the lacrimal sprout to reach the free border of the lid, or again it may be due to faulty lumen formation in the solid epithelial cord after it reaches the free lid margin. Multiple puncta are encountered, there being two, three, or even four puncta, depending on the number of sprouts to reach the lid margin. In this series we have seen one case with two puncta on the lower right lid. Congenital fistulas and diverticuli of the lacrimal sac may exist, and as they always connect with the main passageways they are easily recognized by the X-ray.

The nasolacrimal duct is subject to much the same variations as those just described for the canaliculi and sac. Its outlet, the passage leading into the inferior meatus of the nose, may be represented by one or by multiple openings, the size and position of which may vary greatly. The single ostium is of course the more common. Again, the duct may fail to establish communication with the inferior nasal meatus,

the outlet being occluded by a membrane, or by bony structure. The duct may have an opening into the middle nasal meatus as well as the lower one. The nasolacrimal duct is, as a rule, regular in contour; however, it may show many twists and irregularities, with fistulas and diverticuli. The two canaliculi, the lacrimal sac, and the nasolacrimal duct may present a most bizarre appearance, malformed, snarled, and very grotesque in their contour. It is when faced with the radiograph of such a case that one is most strongly convinced that the passing of a metal probe would not only fail in relieving the stenosis, but would, most likely, create a false passage and leave the patient in a more deplorable condition than when he consulted us. The same criticism may be offered to any of the intranasal operations, which require the passage of metal probes into the inferior nasal meatus.

There are possibly as many variations in "the anatomic type" of the nasolacrimal passageways as there are in the mastoid. Just as the success or failure of non-surgical methods of dealing with acute middle ear and mastoid antrum infections depends in no small degree upon "the anatomic type" of the mastoid and its appendages, just so the "anatomic type" "looms up" in the treatment of the diseased nasolacrimal passages. J. Parsons Shaeffer (4), who is a well-known authority on this subject, in his latest writing laments that there is no way of knowing "what type of duct confronts the operator." We believe that much of the uncertainty can be eliminated by the X-ray.

It is a well-known fact that disease of the nasolacrimal passageways is very infrequent among certain races, notably the negro. We have repeatedly noted, in X-raying the normal passageway, that the nasolacrimal duct is straighter and much wider in the black than in the white race. To this may be ascribed the negro's immunity to acute dacryocystitis. Santos-Fernandez (5) has arrived at a similar conclusion based on anatomic studies.

Operative Cases and Data. In the past year we have operated ten cases of complete obstruction of the lacrimal passageways, following the intranasal method described by Wiener and Sauer (6). We are quite conversant with the fact that the time is far too short to permit of a final statement as to the end

result. All of the ten cases have been seen in our office in the past two months and we are safe in saying that we have never seen patients more pleased or grateful; all have estimated their improvement at 95% or better, and by far the great majority have obtained complete relief. This statement can best be illustrated by reporting in detail our first case.

Mr. P. (Case No. 18135), a young man 27 years old, came into our office February 6, 1920. Chief complaint, troubled with tearing from both eyes for past 6 or 7 years. Had an abscess in the left sac four years ago. This was incised and later removed at Mayo's. Has had no further trouble with abscess formation in this eye, but is continually annoyed by the tears collecting and draining over the lower lid. X-rays taken by us showed the sac had been completely removed. Patient has had the right duct probed many times with no improvement. Our examination showed the right lacrimal passageways to be completely obstructed. Solutions could not be syringed into the nose, the sac was filled with pus, the lower canaliculus had been slit, and there was a moderate degree of argyrosis or staining of the skin on the lower lid from former injections.

The patient refused to have the sac removed because of the trouble he has had with the tearing in the left eye since it was so operated four years ago.

We operated the right sac intranasally, some twelve months ago. The same has remained open. The patient is requiring no treatment and is now having no trouble with tearing in this eye. Tears continue to pour over the lower lid of the left eye. The case offers a beautiful contrast between the two methods, enucleation of the sac and intranasal drainage. We are aware that the criticism may be offered that our new opening may close. This we cannot deny, but we can say that it has shown no tendency to close thus far, and that should it close, it can be easily opened again. In our present state of mind we would hesitate to advise the destruction or the removal of the lacrimal sac, with one possible exception, namely, those cases where the sac is infected and one of the major intraocular operations is to be performed on the eye involved. In such a case we must strive to have a sterile field, and this is possibly best assured if the infected sac is completely removed and the two canaliculi sealed with the cautery.

Post-Operative Data.—We have found the X-ray of considerable value in two groups of post-operative cases.

First, those cases in which the sac has been removed, but which later return complaining that they are able to express

pus from the lacrimal fossa, or may even have had an abscess. Such a complaint would seem to be *prima-facie* evidence that some of the sac remains. Here the surgeon must feel that the attempt to destroy or to remove the sac has not been as complete as was originally planned by radical surgery. This may not be so great a catastrophe as would seem at first thought. In fact, it may work as a great benefit to our patient. If enough sac remains, it may still be possible to do one of the short-circuit operations, and thus clear the sac of infection and establish a more or less normal drainage of the tears into the nose. If the short-circuit operation is not considered feasible, it is then necessary to undertake to remove or to destroy the remaining portion of the sac. In either procedure it is of the greatest value to know how much sac remains and where it is located. This data can be easily obtained by X-raying the sac after the injection of bismuth. The second group includes those cases which may not progress satisfactorily after one of the short-circuit operations. Here the X-ray will show us where the new drainage is at fault and enable us to plan for its correction.

As these studies have progressed, many questions have occurred which we believe the X-ray will aid in answering.

Are all cases of complete lacrimal obstruction suitable for intranasal drainage?

Is the sac which is extremely small and contracted one which should be enucleated, or can it be drained into the nose? Our experience has been that the small sac can be successfully drained into the middle meatus of the nose and that the radiograph showing the location of the sac in reference to the intranasal structures is of great value when one undertakes to open intranasally these small and contracted sacs.

To take the other extreme, the greatly dilated and atonic sac, or even one of the intermediate forms, what is the method of choice here? Does it depend in any way upon the location of the obstruction, or upon the ability of the sac to perform the function normally ascribed to it, that of pumping the tears down the nasolacrimal duct? If so, the X-ray will be of value, first because it will show the location of the obstruction, and second because it will show the size of the sac and give us some idea of its condition. With the normal pumping action of the

lacrimal sac greatly impaired or completely lost as the result of prolonged dilatation, is it not better surgical judgment to resect and drain the lacrimal secretion into the middle meatus of the nose, rather than to persist in our efforts to carry the tears down the long and narrow nasolacrimal duct? Is it necessary in all cases to resect the anterior end of the middle turbinate as is advised by Mosier?

To summarize: It has been possible by these X-ray studies to demonstrate on the living subject:

1. That the nasolacrimal duct and sac may have a side to side joining.
2. The passageways on one side may be very malformed and irregular in their course, while those draining the opposite eye may be regular in contour.
3. The passageways in the black race are, as a rule, much wider and more regular in outline than are found in the white race.
4. The lacrimal sac may as the result of infection and obstruction be extremely dilated, or again it may be very small and contracted, and also there may be fistulæ leading from the sac.
5. By the method herein described it is possible to easily demonstrate the position the lacrimal passageways occupy relative to the middle turbinate.

It would seem that we are justified in concluding that satisfactory X-ray data on the nasolacrimal passageways showing the point of obstruction, the size of the sac, and its position relative to the intranasal structures is of practical value in that it allows us to make a more accurate diagnosis and to plan our relief with greater precision.

REFERENCES.

1. WEST, J. M. *Trans. of Amer. Ophth. Soc.*, 1910, p. 654.
2. TOTI. *Clin. Med.*, No. 35, 1904.
3. SZILY, A. VON. "Pathology of tear passages as revealed by X-ray." *Klin. M. f. Augenh.*, vol. lxiv., 1920, pp. 31-44.
4. SCHAEFFER, J. P. *Nose, paranasal sinuses, nasolacrimal passageways, and olfactory organ in man.* Blackstone, 1919.
5. SANTOS-FERNANDEZ. "Measurements of the nasal canal according to race." *Amer. J. of Ophthalm.*, vol. iv., 1921, pp. 32-38.
6. WIENER, M., AND SAUER, W. E. "Operation for relief of dacryocystitis through nasal route." *J. A. M. A.*, vol. lxxv., 1920, pp. 868-874.

FURTHER OBSERVATIONS OF PROTEIN INJECTIONS IN SEVERE OCULAR INFECTION.¹

BY DR. BEN WITT KEY, NEW YORK.

IN responding to the invitation of our secretary, that I present to you some further observations on protein effects in ocular infection, I confess my hesitation and temerity when I view the present broad scope this subject has recently assumed in all branches of medical study. On the other hand I am of that school which believes in clinical results, however empirical the remedy may seem, and I therefore would offer to you for consideration and discussion some observations, which have been the seat of real interest and study, constant attendance and care, and yet of firm self-abnegation, patient but distrustful course of experiment. Mills attempted to base the law of causality upon an *inductio per enumerationem simplicem*, as an expedient to reduce presuppositions in an indirect way to empirical truths. And yet it is certainly quite evident that only by induction through enumeration can the real value of protein therapy be determined. With this end in view, I am prepared to report briefly to you certain cases of severe ocular infection which I have regarded as indicating a definite protein effect, also reports of cases observed recently by others who have employed this method of combating ocular infection, and finally, I would point out what has been characterized as the non-specific reaction and its probable mechanism of effect.

Protein therapy has become very popular, perhaps too popular. Innumerable kinds and varieties of proteins or non-specific agents have been employed, some empirically, others with a definite immunological theory underlying their use, and yet all of them, whether it be serum, vaccine, enzyme, or

¹ Read before State Medical Society, Albany, N. Y., April 26, 1922.

chemical agent, having more or less constitutional effect upon the patient. It is now well recognized that three papers published by Renaud, by Kraus and by Ichikawa, reporting undeniable clinical results from non-specific therapy, can no longer be swept aside by the laboratory conception of a strictly specific therapy. This has been made clear by series after series of corroborative observations reported in the European literature from many sources, each independent of the other, different agents and methods being employed, and in the treatment of numerous diseases. These authors are too numerous to mention, but prominent among them are,—Paton, Lilienthal, McCallum, Darier, Bingel and others using diphtheritic antitoxin; Deutschmann, "yeast" serum; Schmidt and Saxl, milk injections; Ludke, proteoses or albumoses; Mittlander, hypertonic salt solution. In America, Miller, Lusk, Snyder and Ramirez have employed typhoid vaccine and secondary proteose in their work and have reported large series of cases so treated.

My observations are limited to those following the injection of diphtheritic antitoxin, although I have employed pasteurized sterile milk in two cases. In the latter (cases of advanced hypopyon keratitis), the constitutional reaction was peculiarly violent and from which no noticeable beneficial effect upon the infection could be traced with any degree of certainty.

On the contrary my experience with anti-diphtheritic serum as a non-specific, or para-specific agent,—whichever it may be correctly considered to be in the light of recent researches,—has proven conclusively to me the efficacy of the serum in combating pneumococcic and staphylococcic infections of the refractive media of the eye. To substantiate this conclusion, I am prepared to offer additional evidence to my previous efforts in the study of this subject. In 1919 I reported thirty cases in detail together with numerous observations by other experimenters, published in the *Transactions of the American Ophthalmological Society*, 1919, and in the *ARCHIVES OF OPHTHALMOLOGY*, Nov., 1920. Two years ago I reported before this Society in detail fourteen additional cases together with an analysis of the effects and the probable reaction (*New York State Journal*, January, 1921).

During the past two years I have employed the serum in

twenty-three cases; nine of these being hypopyon keratitis, five infection of anterior segment after penetration, three panophthalmitis, six ulcerus serpens. To relate these cases in detail would consume unnecessary time, and would only be in fact a restatement, with few exceptions, of similar cases, changes, and results as those presented in my previous reports. A brief analysis of these cases, however, seems fitting, in order to emphasize certain phases of this treatment which may prove interesting and worthy of your own observation.

Of the nine cases of hypopyon keratitis, all but two were past middle life; one of these was twenty-six years of age, the other ten years. In both young patients prompt result from serum injection was observed, and convalescence was short. In only two other cases was delayed effect of the injection noted; one of these, G. W., aged sixty-four, admitted September 16, 1920, proved to have a 4+ Wassermann reaction, but promptly responded with the addition of mercury and K. I.; the other case occurred in a man sixty-five years old with extensive corneal destruction, observed two weeks after the onset, and whose physical condition was extremely poor. This bears out the usual history of these cases, since it is well known that hypopyon keratitis occurs commonly in the aged and among debilitated individuals, frequently following upon the neglect of a local injury. These observations were also noted in the forty-four cases I have previously reported and are in keeping with the two fundamental theories as to the biological alterations which take place in the organism after injection of a so-called non-specific agent,—namely, (1) those that involve cellular stimulation, the "Plasmaactivation" of Weichardt, and (2) those resulting from alterations in the permeability of the cells, studied by Luithlen, by Starkenstein and others, and which represents a diphasic phenomenon.

In only one of the nine cases of hypopyon keratitis was the ulcer located in the margin of the cornea, this case being the one related above of syphilitic involvement. Eight cases therefore had the process of ulceration in the center of the cornea, this being the area least protected by systemic resistance, furthest from the source of nourishment (the blood). This observation is also in line with Weichardt's hypothesis of marked increased cellular activity (glandular, muscular and

leucocytic), and with Starkenstein's diphasic changes in the permeability of the capillaries and tissue cells, which results from moderate doses of non-specific agents, such as anti-diphtheritic serum or typhoid vaccine, etc., and which therefore produces so-called "non-specific" resistance to infection in a vital area (center of the cornea) and in an aged and debilitated individual.

In all the cases in which smears or cultures were made, the pneumococcus, as was to be expected, prevailed.

The treatment was similar in all the cases:—cauterization with carbolic acid (concentrated) followed immediately by alcohol (50%); in advanced cases multiple incisions through the ulcerated area, followed by the carbolic and alcohol cauterization. Anti-diphtheritic serum, from 1000 to 3000 units (varying with the age and size of the patient), was injected at the earliest possible moment, this dose being repeated in 48 hours depending upon the reaction observed after the previous injection, and as often thereafter repeated as seemed advisable in the individual case. The usual local treatment of hot fomentations, atropine and bichloride vaseline (1-5000) was fairly routine in all the cases.

Daily observation of these cases revealed changes most of which I have previously mentioned, but which now are almost to be expected as the course of such a case is followed. In twenty-four to forty-eight hours after the initial injection the hypopyon was reduced or had disappeared in all but one case (this being syphilitic); hypopyon reappeared in two cases but disappeared promptly with the injection of the serum. Besides the very noticeable effect upon hypopyon, almost invariably there was relief of pain, rapidly subsiding conjunctival and iritic reaction, and a clearing away of ulcer débris, such as does not usually occur in these cases, the ulcer itself taking on a clear and clean appearance early in the process of repair. Here again we find our observations are perhaps accounted for, are really expressions of the non-specific reaction to serum injection, conclusions arrived at by investigators in larger fields of research than ours. I refer you especially to the researches of Luithlen in 1912, those of Von den Vekden, Siegert, and Starkenstein relative to the increased permeability of the capillaries and cell membrane; those of Dollken and King

relative to the nervous reaction; also those of Heidenhain, Teague and McWilliam, Davis and Petersen relative to the lymphagogue effect following protein or non-specific injections.

Of the five cases of penetrating wound with infection, only one of them—observed late and in a man 46 years old—resisted the stimulating and generally resisting effect of the serum injection, but even this case subsided without violent local symptoms, the anterior chamber clearing entirely of hypopyon, the cornea becoming clear and lustrous—evidence of the lymphagogue effect?—although phthisis of the globe slowly followed. Another of these cases—girl, H. B., 9 years (Hospital No. 6562), ruptured globe with infection,—improved remarkably after serum injection, and although phthisis followed slowly, the anterior segment of the eye in a short time cleared entirely of hypopyon, the cornea remaining clear and lustrous. In another case—T. O., strong and stalwart man of 43 years (Hospital No. 04431), cornea penetrated by nail three days before, hypopyon 2mm, violent conjunctival and iritic reaction—definite signs of repair and relief of pain followed the initial injection of 3000 units, hypopyon gradually disappeared, reaction subsided, and he was discharged after 12 injections of the serum, the eye being entirely quiet, the anterior segment clear and lustrous as the normal eye. In another case—F. C., man, 29 years (Hospital No. 7211), penetrating wound of cornea, admitted March 27, 1922, *no* hypopyon; *third* day in spite of the usual intensive local treatment hypopyon 2mm developed over night, lips of wound were whitish, entire cornea hazy, usual iritic reaction—not *until* hypopyon developed was the serum injected, 3000 units. A peculiarly violent local and constitutional reaction followed (great oedema of the injected arm, temperature $101\frac{1}{2}$, nausea and headache, mild erythema of arm and body), but in 24 hours there was coincident with this general reaction, relief of ocular pain and definite reduction in the hypopyon, which disappeared entirely in 48 hours, and daily improvement (clearing of the anterior segment) allowed his discharge 10 days later. Could this complete reversal in the behavior of an anterior infection be attributed to sudden systemic stimulation ("Omnicellular Plasmaactivation" of Weichardt) and increased local resistance through increased permeability of the capillaries and cellular

elements induced by the protein injection? My answer is, that at least such effects as these, undeniably demonstrated, can not be ignored. It is quite evident that the best opportunity for observation of the clinical effects is offered by cases of penetrating wound of the cornea with infection, because the only local treatment administered is that of hot fomentations and atropine, antiseptics being of little value, whereas in *ulcus serpens* with hypopyon, the effect of cauterization and local antiseptics can not be as clearly separated in many cases from the effect induced by protein injection.

Of the three cases of panophthalmitis, two occurred following penetration, one after cataract extraction. Would that time permitted to relate these in detail, for in each case there was evidence of local resistance to the infection. Suffice it to say, that in one case the eye slowly quieted, anterior segment cleared entirely, all conjunctival reaction subsided, the eye, now one year old, is soft, of good appearance, and he refuses enucleation. A second case, very similar to the first remains under observation. The third case, observed at the very onset of the infection, received 3000 units, with marked improvement in 24 hours, but subsequent injections failed to check the process, and slowly but quietly, only moderate reaction being present, disintegration of the globe continued. At this time, however, the anterior segment is unusually clear as though irrigated by a lymphagogue effect of some systemic influence (protein?).

Six cases of *ulcus serpens* are mentioned as being treated with the serum, merely to indicate the character of case best suited for protein therapy. The results are found in these cases. In all but two of them cauterization was used, because the ulcer was almost invariably located centrally, and most frequently in patients past middle life, and to delay local intensive measures, in order to observe the serum effect, would prove little and risk much. Furthermore, under such conditions, where delay was possible and justified, improvement and healing may have occurred anyway, regardless of injection without intensive antiseptic measures. Here the *natural* forces of resistance may have been sufficient without either injection or antiseptic aid.

Aside from my own observations on this subject, I wish to

call your attention to the experience of others who have used anti-diphtheritic serum as an aid in combating ocular infection. Dr. Shober Smith has kindly presented to me the histories of four cases, in which he recently used the serum. Two of these were cases of hypopyon keratitis, in which the hypopyon disappeared in 48 hours after injection, both cases proceeding rapidly to a satisfactory result; one case of penetration with infection of wound and hypopyon (2mm) yielded promptly to injection, in 24 hours hypopyon disappeared, all symptoms rapidly subsided; one case of infection after iridectomy in a man 73 years old, hypopyon and cloudy anterior segment second day, serum injected with disappearance of hypopyon in 24 hours, and recovery; later extraction of the lens yielded vision = $\frac{1}{2}$. Dr. F. W. Shine has employed the serum in five cases; one of these a case of hopeless sympathetic ophthalmia and in which in 48 hours there was definite evidence of a clearing of the anterior segment; also a case of infection after cataract extraction, which promptly yielded to treatment and recovery. Another case of post-operative infection in which he was uncertain of any effect; also two cases of ulcer serpens, in one of which no effect could be detected, the other recovered without event. Dr. G. H. Bell has used the injections in a number of cases and believes in the efficacy of the treatment. Dr. Henry L. Sloan, Charlotte, N. C., reports a case of infection after penetration which was definitely improved by diphtheria antitoxin injections. Dr. de Schweinitz reports a case of hypopyon keratitis unaffected by intensive local measures; 30 hours after injection of 1500 units of anti-diphtheritic serum improvement was noted, and the condition subsided after further injections of the serum. At the next meeting of the American Ophthalmological Society, Dr. H. F. Hansell and Dr. G. O. Ring, Philadelphia, will present a paper which concerns itself with the report of four cases of post-operative infection and one case of violent infection following foreign body in vitreous. Each of these cases they believe to have been cured by the administration of diphtheria antitoxin.

NON-SPECIFIC REACTION

During the past five years this subject has received such wide attention, yielding innumerable clinical observations and

intensive experimentation, that correlated data from many sources has begun to focus upon a common ground of understanding as to the reaction of the organism to non-specific therapy and the mechanism of this reaction. This study has grown out of nature's own methods of resistance and repair, constantly demonstrated by the reaction from counter-irritants, vaccines, enzymes, drugs, yeasts, colloidal metals, etc. It is believed, therefore, that in a similar manner there is brought about in the body true tissue stimulation and activation, the therapeutic effect being produced by altering the reactivity of the whole organism, rather than directly influencing the cause of the pathological process.

This reaction is expressed (depending upon the character and amount of the agent injected and the sensitization of the particular individual to it) by a chill, rise in temperature, variations in pulse and blood pressure, sweating, nausea, nervous irritability, skin reaction, glandular activity, permeability of the capillaries, lymphagogue effect, and certain variations in the blood—such as concentration, leucocytic response, increased anti-fermentation, and alteration in the antibody titer of the serum of the patient. Luithlen determined the permeability of the abdominal capillaries by injecting sodium iodid into the veins of rabbits and tested the rate at which it entered into the Ringer's solution which he had injected into the peritoneal cavity. Siegert and also Schmidt found that small doses of protein increased the permeability. Starkenstein produced corneal ulcers in rabbits, then observed the rate at which dyes would diffuse out at the site of the lesion after a variety of non-specific injections. It was concluded that non-specific injections increased the permeability of the capillaries for a short period and later caused a definite lessening of the permeability. Heidenhain classifies certain proteins as lymphagogues because of the marked increase in the lymph flow which they produce. Teague and McWilliam believe the lymphagogue effect is responsible largely for the therapeutic influence of protein injections, because the antibodies of the blood stream are forced into the lymph spaces and there may destroy the invading micro-organisms. Davis and Petersen investigated this effect upon the lymph flow, using dogs in whom a lymph fistula was made at the thoracic duct and

then injecting killed colon vaccine intravenously to produce the shock effect. It occurs to me that the above related experiments are highly significant when one repeatedly observes the effect of diphtheritic antitoxin upon the lymphatic structures of the eye, the effect upon hypopyon, and clearing of the anterior segment, already alluded to.

Some believe that the chief factor in the therapeutic result is from leucocytic stimulation, but this point is variously regarded, since many conflicting experimental results are reported. Others believe the therapeutic effect is due to some alteration in the antibody titer of the serum of the patient. This theory also is the subject of much debate and of continued experimental tests. The popular explanation is found in the general stimulation of the protoplasm (Weichardt) and in the permeability of the cell membrane (Luithlen and Starkenstein.) Permeability of the capillaries is increased as evidenced in the increased lymph flow and in the concentration of the blood; permeability of the tissue cells is increased, with an outpouring enzymes, immune bodies, etc.; increased permeability of the nerve cells is associated with a lowering of the threshold for nervous impulses and is manifested clinically in increased irritability, headache, and susceptibility to pain. When this first phase has passed a compensatory phase of lessened permeability of the cells occurs, with lessened nervous irritation and susceptibility to pain—lessened exudation—a lowering of enzyme concentration, etc.

With these investigations in mind, I have recently given sub-tenon injections of warm hypertonic salt solution at three to twelve hour intervals after injection of the serum, for the purpose of increasing locally the flow of lymph, increasing the permeability of the capillaries, and stimulating leucocytic activity. Only four cases have been so treated, but the effect noted is worthy of mention, and leads me to believe that with more light upon the subject of administration and dosage in relation to the stage of the infectious process and the time of other treatment, one may administer the serum with more confidence in the effect.

I wish to extend my thanks and appreciation to Dr. W. E. Lambert, on whose service at the New York Eye & Ear Infirmary most of these cases have been studied.

REFERENCES.

- BINGEL, A. "Über Behandlung der Diphtherie mit gewöhnlichen Pferdeserum." *Deutsch. Arch. klin. Med.*, 1918, cxxv., 284.
- DARIER, A. "Sérothérapie des ulcères infectieux de cornée." *La Clin. Ophthal.*, Feb. 25, 1907, p. 35.
- DARIER, A. "Conclusions sur la serothérapie dans les infections oculaires." *La Clin. Ophthal.*, 1910, p. 573.
- DARIER, A. "Sérothérapie dans les infections oculaires." *La Clin. Ophthal.*, 1911, p. 22.
- DARIER, A. "Vaccines and serums in ophthalmic therapy." (Twelfth Int. Oph. Congress, Petrograd). *Ophthalmoscope*, 1914, vol. xiii., p. 263.
- DARIER, A. "Des injections parenterales de lait de vache." *Clin. Ophth.*, 1919, xxiii., p. 131.
- DAVIS, B. F., and PETERSEN, W. F. "A comparative study of lymph and serum ferments during serum shock reactions." *J. Exp. Med.*, 1917, xxvi., p. 84.
- DEUTSCHMANN, R. "Mein Heilserum." *Beiträge z. Augenh.*, 1907, Heft 69.
- DEUTSCHMANN, R. "Ein neues tierisches Heilserum gegen mikrobiische Infektionen beim Menschen." *München med. Wchnschr.*, 1907, liv., 921 and 1214 (correspondenz).
- DOLLKEN. "Ueber Heilung tabischer Erscheinungen durch Arsen und durch Bakterienpräparate." *Berl. klin. Wchnschr.*, 1913, p. 962.
- DOLLKEN. "Ueber die elektiven Wirkungen der Heterovakzine und Proteinkörper." *München. med. Wchnschr.*, 1919, lxvi., 480.
- DOLLKEN. "Zur Therapie und Pathologie der Abbankrankheiten des Nervensystems-Heilwirkung der Proteinkörpertherapie auf die Epilepsie." *Berl. klin. Wchnschr.*, 1920, lxii., 893 and 926.
- ICHIKAWA, S. "Abortivebehandlung von typhosen Krankheiten." *Ztschr. f. Immunitätsforsch.*, 1914-15, xxxii., Orig. 32.
- KING-TURNER, A. C. "The treatment of epilepsy by colossal palladium." *Brit. Med. J.*, ii., 255.
- KRAUS, R., and BELTRAMI. "Experimentelle Prüfung der Wirksamkeit des Normalen Rinderserums gegenüber der Milzbrandinfektion," *Ztschr. f. Immunitätsforsch.*, 1921, xxxi., 93.
- KRAUS, R., and SORDELLI, A. "Experimentelles zur Frage der Heilwirkung des normalen Pferdeserums bei der Diphtherie." *Ztschr. f. Immunitätsforsch.*, 1921, xxxi., 107.
- LILIENTHAL, H. "Serum therapy in acute surgical infectious diseases." *Med. News*, 1897, lxxi., 65.
- LUDKE, H. "Die Behandlung des Abdominaltyphus mit intravenösen Injektionen von Albumosen." *München. med. Wchnschr.*, 1915, lxxii., 321.
- LUDKE, H. "Ueber Albumosentherapie." *Berl. klin. Wchnschr.*, 1920, lxii., 344.
- LUITHLEN, F. "Veränderungen der Hautreaktion bei Injektion von

- Serum und Kolloidalen Substanzen." *Wien. klin. Wchnschr.*, 1913 xxvi., 321.
- LUITHLEN, F. "Ueber die Einwirkung parenteral eingefahrter Kolloide und wiederholter Aderlasse auf die Durchlassigkeit der Gefusse." *Med. Klin.*, 1913, ix., 171.
- LUITHLEN, F. "Zur Kenntniss der Wirkung der Vakzine." *Wien. klin. Wchnschr.*, 1916, xxix., 253.
- LUITHLEN, F. "Aderlass, ein Teil der Kolloidtherapie." *Wien. klin. Wchnschr.*, 1919, xxxii., 1024 and 1081.
- McCALLUM. "Preliminary report on the action of Behring's serum in diseases not due to the Klebs-Loeffler bacillus." *Brit. Med. J.*, 1897, ii., 1189. (Mentioned in editorial *Therap. Gaz.*, 1898, s. 3, xiv., 37.)
- MILLER, J. L., and LUSK, F. B. "The treatment of arthritis by the intravenous injection of foreign protein." *Jour. A. M. A.*, 1916, lxvi., 1756.
- MILLER, J. L., "Foreign protein therapy in acute infections." *Jour. A. M. A.*, 1920, lxvi., 308.
- MILLER, J. L. "The intravenous use of typhoid vaccine and foreign protein in the treatment of typhoid fever." *Illinois Med. Jour.*, 1916, xxix., 8.
- MITTLANDER. "The treatment of typhoid with intravenous injection of salt solution." *Jour. A. M. A.*, 1916, lxvi., 1321. (Budapest letter.)
- PATON, D. M. "A further contribution to a new generalization in serum therapy." *Australasian Med. Gaz.*, 1910, xxix., 601.
- PETERSEN, W. F. "The ferment-antifermen balance and its relation to therapeusis." *Arch. Int. Med.*, 1917, xx., 515.
- PETERSEN, W. F. *Protein therapy and nonspecific resistance.* Published 1922.
- PETERSEN, W. F. "Serum changes following protein 'shock' therapy." *Arch. Int. Med.*, 1917, xx., 716.
- PETERSEN, W. F. "Factors in resistance to tuberculosis." *Arch. Int. Med.*, 1918, xxi., 14.
- RENAUD, M. "Vaccin Thérapie par les vaccins irradiés." *Presse med.*, 1911, xix., 585.
- RENAUD, M. "Résultats Thérapeutiques obtenus par l'emploi du vaccin technique irradié." *Presse med.*, 1911, 665.
- SAXL, P. "Ueber die Behandlung von Typhus mit Milchinjektionen." *Wien. klin. Wchnschr.*, 1916, xxix., 1043.
- SCHMIDT, R. "Ueber Proteinkörpertherapie und über parenterale Zufuhr von Milch." *Med. Klin.*, 1916, xii., 171.
- SCHMIDT, R. "Über das Problem der Proteinkörpertherapie." *Med. Klin.*, 1920, xvi., 691.
- SNYDER, R. G., and RAMIREZ, M. A. "The intravenous use of foreign protein in the treatment of chronic cases of arthritis." *Arch. of Internal Med.*, July, 1921, p. 50.
- SNYDER, R. G. "A clinical report of nonspecific protein therapy in the treatment of arthritis." *Arch. of Internal Med.*, Aug., 1918, p. 224.

- STARCKENSTEIN, E. "Proteinkörpertherapie und Entzündungshemmung." *München. med. Wchnschr.*, 1919, lxvi., 205.
- TEAGUE, O., and McWILLIAM, H. I. "Intravenous vaccine therapy." *J. Immunology*, 1917, ii., 375.
- VON DEN VEKDEN, R. "Beitrage zur parenteralen Proteinkörpertherapie," *Berl. klin. Wchnschr.*, 1919, lvi., 481.
- WEICHARDT, W. "Ueber die unspezifische Therapie con Infektionskrankheiten." *München. med. Wchnschr.*, 1915, lxii., 1525.
- WEICHARDT, W. "Beitrage zur Proteinkörpertherapie." *Wien. klin. Med.*, 1916, xxix., 1611.
- WEICHARDT, W. "Ueber Unspezifische Leistungsteigerungen (Protoplasmaaktivierung). *München. med. Wchnschr.*, 1920, lxvii., 91.
- WEICHARDT, W. "Über die Aktivierung durch unspezifische Therapie." *München. med. Wchnschr.*, 1921, lxviii., 365.

THE PATHOLOGY OF UVEITIS.¹

BY DR. SANFORD R. GIFFORD, OMAHA, NEBRASKA.

(*With three illustrations on Text-Plate XX.*)

THIS paper will attempt briefly a review of the events seen clinically in the principal forms of uveitis, in the light of the pathologic processes involved, bringing in histology only where it seems to throw light on these processes. While we are all most interested just now in uveitis due to focal infections, the diagnosis in a case of iritis is not finished when we are informed of a root abscess or an infected pair of tonsils. I have had three cases during the past year which have shown, besides throat, nose or tooth pathology, both a four plus Wassermann and a positive tuberculin test. In such cases, one's clinical judgment often needs all the help that a knowledge of the pathology in question can give it.

SYPHILIS.

The ordinary iritis fibrinosa of syphilis shows no absolutely specific clinical signs, and may show none even in sections. Typically, however, its seat is in the deeper layers of the iris, and this results in lesions different from those of so-called rheumatic iritis which affects chiefly the anterior layers. The whole iris is swollen and oedematous. The exudate in the posterior layers binds them firmly to the lens capsule, so that the synechiaæ include not only the pigment layer, but the iris stroma, and these thick bands are seen when the pupil is dilated, forming pointed or tongue-shaped irregularities in the pupil. Due as it is to a peri- and endarteritis, the formation of

¹ Read before the Chicago Ophthalmological Society, April, 1921.

perivascular nodules of round-cell infiltration is characteristic. Though often too small to be seen grossly, specimens removed at iridectomy, as by von Michel, (1) have usually shown their presence about inflamed and even obliterated vessels. When closely searched for, larger nodules are sometimes just perceptible to the loupe, and when found, help materially in the diagnosis. The deposits on Descemet's membrane often show a zone of infiltration around them which may exceptionally extend so deeply as to leave scars interfering with vision. Rarely, spirochætes may be deposited in these areas and set up foci of active infection. By analogy with lesions elsewhere, spirochætes are probably always present in small numbers in the iris nodules. Myashita and Nakamura have recently reported a case of hemorrhagic iritis in which spirochætes were found. A recent report by Rumbaur (2) with pathologic findings, indicates that the iritis of hereditary lues presents a picture different from that in the acquired form, the infiltration affecting the iris stroma and the vessels being almost entirely spared.

This form of iritis is an early secondary manifestation of syphilis. Half of Badal's (3) cases occurred in the first year after infection, a large number in the eighth month, so that it may be considered to correspond with the specific sore throat.

The later forms, papules and gummata, while more definite in their pathology, are not so important for diagnosis and are less often seen. Most pathologists now admit that there is no essential histological difference between the lesions called papules and those called gummata. The principal difference is one of size, the early lesions remaining small and often absorbing without breaking down, while the later ones grow larger, the central vessels are obliterated, and necrosis takes place with caseation and the appearance of giant cells. But all stages between the smallest papule and the largest gumma occur. In a recent series reported by Clapp (4) nodules of both types together occurred in 8% of cases. In a series of Badal, they composed 5%.

In the iris, the early lesions, coming on often at the same time as a papular skin eruption, should properly be called papules. They develop in the deep layers of the iris, nearly always in the region of the sphincter and push up the stroma

till they are seen on the anterior surface through a thinned layer of stroma. They are characteristically round and the longer the interval between the primary lesion and their appearance, the larger and more solid they are apt to be. They usually absorb slowly but may burst into the anterior chamber, due to a breaking down at their centers.

The so-called gummata all appear at the iris-root, and most of them originate in the ciliary body. They form tumors as large as the lens or larger, often filling the anterior chamber and perforating the sclera at the limbus. Scleritic nodules may be formed by direct extension before the growth ever appears in the iris root.

These growths, while occurring later than the papules, are, as a rule, earlier than so-called gummata, arising anywhere else in the body. Hanke's large growth occurred six months after the primary and many others occurred in the presence of a papular rash. The term condyloma, which I notice Clapp uses in his article, should imply granulation tissue on a moist mucous or epithelial surface and I believe should not be applied to iris lesions.

In the choroid, nodules which may be called papules, or more usually gummata, occur; usually somewhat later than in the iris. The commoner diffuse luetic choroiditis is an early secondary sign and analogous to diffuse iritis. Though no nodules may be seen clinically, the oedema and inflammation of the choroid is due to the formation of numerous very small peri-vascular nodules of infiltrate, and it is at the site of these that the lamina vitrea is broken through, the pigment layer is involved, the retina is bound down to the choroid by exudate and proliferation of the pigment layer occurs, resulting in the black spots seen when the exudate has absorbed. Where the nodules are larger, defects in the pigment epithelium are left and the pigment cells at the border proliferate to form the black rim of the resulting white spot. The different fundus pictures produced by syphilitic choroiditis, acquired and hereditary, seem to depend on the site of the exudate and its distribution in larger or smaller nodules. About 9.5% of disseminated choroiditis is due to syphilis, and the few cases examined microscopically show no essential difference from that due to other causes. Sidler-Huguenin (5) has suggested

an interesting classification of the types of choroiditis occurring in hereditary lues, but purely on a clinical basis.

TUBERCULOSIS.

Diffuse iritis corresponding to that of lues is probably one of the rarest ocular manifestations of tuberculosis. Usually nodules occur which are small tubercles, but their site is often in the deeper layers, so that they cannot be seen clinically. The exudate in the deep layers causes dense adhesions to the lens capsule, so that the synechia, as in luetic iritis, involve the iris stroma. Sections usually show very small tubercles and the bacilli may be found in these in a fair number of cases. The exudate thrown out, though it may cover the pupil, is poor in cells and fibrin, and seldom leads to seclusic pupillæ, though I have seen this occur.

So-called serous iritis is not uncommon, where precipitates on Descemet's may be the only clinical sign; and indicate an involvement of the ciliary body, usually with formation of tubercles. The precipitates may carry tubercle bacilli, and Krückmann (6) describes the formation of tubercles with giant-cells on Descemet's. The larger tubercles of the iris need little remark. They are typically white or grayish, and millet-seed in size. In contra-distinction to luetic papules, they may occur in any part of the iris, and usually several are seen at once in different parts. Larger conglomerate tubercles more rarely occur, and on breaking down, form masses of tubercular granulation tissue in the anterior chamber.

Both tubercular and luetic nodules, when they are absorbed, leave atrophic defects in the iris stroma through which the pigment epithelium is seen.

In the choroid, besides appearing in about 35% of miliary tuberculosis, single or multiple tubercles are seen in other forms of tuberculosis. Their pathology is that of tubercles elsewhere. The exudate on their surfaces may cause detachment of the retina or adhesions may occur with involvement of the retina. When these break down, masses of tuberculous granulation tissue may form pseudo-tumors in the vitreous.

A certain number of cases of disseminated choroiditis are of tuberculous origin, as Stock (7) has proved, but their pathology so far as it has been worked out, shows nothing specific.

SYMPATHETIC UVEITIS.

Though the pathologic changes in Sympathetic Ophthalmia, mono-nuclear infiltration with the occurrence of giant cells and epithelioid cells, are well-known to most clinicians, there is still some dispute as to whether this picture is pathognomonic of S. O. Gradle (8) has reported such changes in eyes removed for traumatic irido-cyclitis when the other eye showed no signs of inflammation, and it is of some importance to know whether similar changes may occur in any case of traumatic irido-cyclitis or whether these eyes were potentially sympathogenic, and would have caused S. O. if they had been left. There is no doubt that the original polymorpho-nuclear reaction following trauma by an infected foreign body is later more or less replaced by mono-nuclears if the infection continues active in a sub-acute or chronic form. Large mono-nuclears and even giant-cells are known to occur in such chronic infections, in the eye as well as elsewhere. But it is surprising how many eyes which have remained irritable for several months or longer after the wound, show on section almost no cellular reaction at all; only a scarred choroid with proliferation of pigment cells, and a fibrinous exudate near the site of the wound from which most of the cells have disappeared. Where some cellular infiltrate is left, it is usually confined to several points, at the site of the wound, around Schlemm's canal, and around the perforating ciliary vessels.

In the eyes that I have examined (about six in number) which were removed on account of definite sympathetic inflammation in the second eye, the cellular infiltrate involved nearly the whole uveal tract. Nodules of round cells were found all through the choroid and iris; the round cells of the choroid were much increased in number, and often the whole choroid was two to four times its normal thickness, being a solid mass of large and small mono-nuclear infiltrate. (Figs. 1 and 2.)

Though caseation has been described, I have never, in these masses, seen any indication of a breaking down process. There seems to be an active proliferation which produces a picture resembling, in some cases, a new growth.

Giant cells I have not found very frequently, in fact, perfectly definite giant cells were very hard to find in my sections.

The characteristic thing to me seems to be the involvement of the whole uveal tract in the cellular reaction with the absence of a tendency to break down.

In view of Ichikawa's (9) report last year of finding in sections of S. O. peculiar fusiform bodies which he considered characteristic of S. O., possibly fusiform bacilli and possibly crystals, it seems worth reporting an accident which occurred to me. On making smears of the vitreous and choroid of a guinea-pig which I had injected with a fusiform bacillus, many fusiform bodies were found and since fusiform bacilli were grown in pure culture from the vitreous, the bodies were considered bacilli. Later, however, in similar smears from a guinea-pig's eye injected with an entirely different organism, the same bodies were seen. A normal eye, when the membranes were pressed down on the slide so that the choroid was traumatized, showed them in large numbers. I was unable to stain them by the technique described by Ichikawa, but considered them pigment crystals. I have not seen them in human sections, but their resemblance to Ichikawa's bodies is at least interesting. (See Fig. 3.)

FOCAL INFECTION.

The cases of uveitis which we now know are due to focal infection conform typically to the rheumatic uveitis of the older writers. In the iris they affect principally the anterior layers, which are swollen and oedematous with fibrinous fluid. The anterior endothelium is raised in places and where it breaks down deposits of fibrin are seen on its surface. In cases that remain long untreated, the anterior chamber is filled with a fibrinous fluid, in which are a few leucocytes. The bands of fibrin become attached to the corneal endothelium and according to Krückmann, it is these fibrinous attachments which cause many of the fine spots seen on Descemet's.

When the pupil is dilated, the central bands of fibrin are drawn upon and broken from their attachments. Then the posterior synechia are revealed, where the exudate has been in contact with the lens capsule. These synechiæ usually affect only the posterior pigment epithelium, which is torn loose, leaving rounded brown indentations of the pupil, and

these brown synechiæ, in which no iris-stroma is included, help to distinguish the case from one of the deeper forms of iritis.

In the acute form, no gross nodules are formed, but in chronic cases the spots of localized œdema in the iris become confluent and deeper infiltration may occur. When the cause is removed the œdema absorbs, and aside from the synechiæ, little or no atrophic changes are seen in the iris.

The gonorrhœal cases are properly to be included in this group and typically differ little from the "rheumatic" forms. They run a more chronic course, but rarely affect severely the ciliary body and almost never the choroid. Some writers believe that the appearance of a hypopyon-like exudate in the early stage which is soon absorbed is suggestive of a gonorrhœal origin.

In the so-called rheumatic forms the ciliary body is often affected and indeed it is questionable if in every case of diffuse iritis some cyclitis is not always present. Fuchs has shown that the deposits on Descemet's originate chiefly in the ciliary body, as masses of similar lymphocytes are found on the bands of the zonula and the cells on the cornea often contain uveal pigment. They lie in small clumps on an intact endothelium which may later break down by long contact. Descemet's membrane, however, is seldom if ever broken down, so that for this type, the term Descemetitis is entirely misleading. Snellen, Jr. (quoted by Parsons, 10) found bacteria in these clumps of cells, but they are not usually present. The larger clumps often show hyaline degeneration forming what the English call "Mutton-fat keratitis punctata."

The choroiditis due to focal infections may be of various types, and is hard to distinguish from other forms, especially from luetic choroiditis. Even the microscopic anatomy is rather similar to diffuse forms of the latter condition, the basis of both being peri-vascular round cell infiltration. Here, too, the later changes most commonly seen, are due to degeneration of the pigment epithelium, consequent to a breaking down of the lamina vitrea or to the filtration of toxins through it, with resulting absence of pigment over certain areas and heaping up of pigment cells at others. Pigment granules freed from broken down cells are also taken up by leucocytes and carried

into the retina or superficial layers of the choroid, producing the fine pepper and salt appearance sometimes seen.

These rheumatic cases are naturally seldom investigated anatomically or bacteriologically. The lesions produced in animals by Rosenow (11) and by Brown, Irons, and Nadler, (12) are comparable, however, and in them streptococci are found in the iris. On account of the production of a septicæmia, their lesions were much more severe than are seen in ordinary cases due to focal infection, and the same may be said of those produced by von Michel with silver nitrate.

The old idea that these cases are caused by absorption of toxins is probably, in most cases, erroneous.

Since the organisms in question, chiefly streptococci, but also staphylococci, pneumococci and gonococci, produce only endotoxins which could reach the eye only in very small quantities, it is probable that almost all these cases are really metastatic, originating in bacterial emboli, of living virulent organisms in the severe cases, and of dead or attenuated ones in the milder cases. Metastatic uveitis usually implies the severe acute inflammations with pus formation occurring in pneumonia, influenza, or other septicæmias, which usually end in panophthalmitis. In this connection, Benedict's (13) recent report is of interest, showing that severe irido-cyclitis may be produced fairly often by injections of certain strains of bacteria into the blood stream of animals. In a personal communication he states that purulent panophthalmitis was never produced by these injections.

Purulent iritis and choroiditis are seen in similar conditions where the exudate and infiltrate on the iris and in the iris and choroid is frankly purulent; but which heal by extensive connective tissue formation without the picture of panophthalmitis. It is probable, however, that all stages may be seen between these massive metastases of virulent organisms, and the smaller ones occurring in focal conditions, where only a few organisms find their way into the blood stream at any one time.

SUMMARY.

While all types have numerous exceptions, the typical cases show, according to their etiology, certain pathologic differences which may often be made out clinically.

1. The cases due to focal infection show an affection of the anterior layers of the iris with synechiæ involving only the pigment epithelium, and seldom show any formation of nodular infiltrates.

2. Cases due to lues and tuberculosis show lesions of the deeper layers with broad synechiæ including iris-stroma. Nodule formation occurs in most cases, in many of which it can be seen clinically. The larger nodules of each disease are usually clinically distinct and cases of tubercular uveitis without demonstrable tubercles are relatively rare.

3. Sympathetic ophthalmia is characterized by a diffuse mono-nuclear infiltration of almost the whole uveal tract which may often be made out clinically, especially where the fundus can be seen.

BIBLIOGRAPHY.

1. VON MICHEL. *A. J. Oph.*, 1881, vol. xxvii., p. 594.
2. RUMBAUR. *K. M. f. A.*, 1921, vol. lxvi., p. 61.
3. BADAL. *A. d'Oph.*, 1886, vol. vi., p. 104.
4. CLAPP. *Am. J. Oph.*, 1921, vol. iv., p. 294.
5. SIDLER-HUGUENIN. *Beit. z. Aug.*, vol. vi., p. 1.
6. KRÜCKMANN. *Graefe-Saemisch Hdbch.*, 1908, II., Kap. VI., p. 11.
7. STOCK. In Parson's *Pathology of the Eye*, New York, 1906, ii., p. 449.
8. GRADLE. *Arch. of Oph.*, 1910, vol. xxxix., p. 567.
9. ICHIKAWA. *Am. J. Oph.*, 1919, vol. ii., p. 1.
10. SNELLEN, JR. In Parson's *Pathology of the Eye*, New York, 1906, vol. i., Part I., p. 286.
11. ROSENOW. *J. Inf. Dis.*, 1915, vol. xvii., p. 403.
12. BROWN, IRONS & NADLER. *Arch. of Oph.*, 1916, vol. xliv., p. 228.
13. BENEDICT. *Arch. of Oph.*, 1921, vol. 1., p. 560.

REPORT OF THE PROCEEDINGS OF THE SECTION
ON OPHTHALMOLOGY OF THE NEW YORK
ACADEMY OF MEDICINE.

BY DR. BEN WITT KEY, SECRETARY.

MEETING OF MARCH 20, 1922. DR. J. M. WHEELER, CHAIRMAN.

A case of **voluntary tremor of the eyeballs** was presented by Dr. JULIUS WOLFF.

K., aged 12 years, a deaf-mute, with normal vision, stated that her eyes often shook when she had to use them. On close examination the eyes suddenly began to make very rapid horizontal motions back and forth, the excursions being about 4mm. The movements did not resemble the slower, oscillating movements of nystagmus but could be described as a rapid, horizontal tremor, occasionally a rotary motion being added. The patient has these movements completely under voluntary control and is able to start or stop them on command. She can elicit the same movements, but to a much less degree, when the eyes are turned to either side or raised or lowered.

Dr. Wolff said he explains this induced tremor by assuming that the patient simultaneously innervates all antagonists concerned in horizontal movements and thereby produces a tremor analogous to that which any one can induce in the hand by holding the forearm very rigid. He had observed the child on several occasions and the result was always the same. He believed that the tremor does not represent a pathological condition but merely an unusual control over the eye-muscles.

Dr. T. H. CURTIN read the history of a case of **tumor of the hypophysis**: A. C. R., aged 41 years, weighing 238 pounds, acromegalic in appearance, complained of blurred vision, metamorphopsia, general malaise and dizziness. Right eye

= $\frac{2}{3}$; left eye = fingers at one foot; pupils react normally, fields normal. Double choked disk, 5-6 dioptries; hemorrhages in macular region. X-ray showed "enlarged sella; clinoids eroded; sella apparently rests within sphenoidal sinus."

Dr. CLYDE E. McDANNALD reported a case of **bilateral papilloedema due to tumor of cerebellum, post-operative.**

Man, aged 37 years, complained of headache 18 months before. The pain was dull and constant in the upper part and back of his head radiating down his back, always more severe in the morning. Occasional paroxysms of pain would prostrate him and he would become bathed in perspiration. There was no nausea or vomiting.

Vision, O. D. $\frac{2}{3}$; O. S. $\frac{2}{3}$ unimproved with glasses; muscle balance unaltered; pupils equal in size and normal in reaction; nerve-heads elevated, red and oedematous; right fundus showed retinal hemorrhages and albescence spots resembling somewhat those in albuminuric retinitis. Fields were not altered; no scotoma or enlargement of the blind spots. Reflexes were normal. X-ray, urinalysis, blood and spinal Wassermanns were all negative. Diagnosis: tumor in the posterior fossa, and patient referred to Neurological Institute.

On March 3, 1922, after operation, vision O. D. $\frac{2}{3}$; O. S. $\frac{2}{3}$. Right showed a receding neuritis with absorbing retinal hemorrhages; albescence spots remained, arteries fairly thin. Left eye showed receding neuritis, no hemorrhages, two small spots nasalward. March 16, 1922, O. D. $\frac{2}{3}$; O. S. $\frac{2}{3}$.

Report of the operation was as follows: "A sub-occipital craniotomy was performed on January 17th, exposing a large tumor 12cm by 8cm having its origin from the sub-tentorial surface of the dura. It extended downward, pushing the cerebellum before it and extending on the vermis. Diagnosis: Endothelioma."

A **symposium** on the **value** of the **Wassermann test** was the subject of papers by the following authors from the viewpoint of their special branches of medical study.

Dr. C. G. DARLINGTON, from the **serologist's** point of view, first explained the meaning of the term 4 plus Wassermann and the value of the quantitative Wassermann, and pointed out that the method and time of fixation as well as the antigen used must be known to the physician in order to properly interpret

Wassermann reports. For example a fifty-minute heat fixation with cholesterin antigen and a four-hour ice box fixation with plain alcoholic antigen would give more nearly equal results.

Referring to Wassermann reactions in children he stated, as result of a study of 1000 consecutive cases, that cholesterin antigen in children seems to be less reliable than in adults (gives more non-specific fixations, and autopsies on children with 4 plus cholesterin findings showed no evidence of lues).

Regarding the Wassermann test in diseases of central nervous system, after a study and analysis of the first routine 10,000 specimens during the past year at Bellevue Hospital, he concluded that all the positive results were apparently from cases of nervous disorders. Furthermore, it seemed that neural changes in syphilis are often overlooked, which should and could be recognized, were more and earlier lumbar punctures made.

He numerated leprosy, yaws and trypanosomiasis as that group of diseases in which there is no doubt but that the disease in question gives a positive Wassermann per se. In a second group (in which at various times a positive test has been reported as occurring) he placed the following: pneumonia, diabetes, lead poisoning, malaria, typhus, liver conditions, occasionally after ether and chloroform, uremia, pregnancy, relapsing fever, scarlet fever, brain and cord tumors, thyrogenous psychosis, tuberculosis, Vincent's angina, and pellagra.

Concerning the Wassermann test in ocular disease, his study of some 33,000 Wassermann records, 207 satisfactory results were reported. Analysis of these led him to conclude that plain alcohol four hour ice and cholesterin 50 minute heat have nearly equal value. A slightly higher percentage of positives were obtained with cholesterin and heat. He emphasized that cholesterin antigen has its primary place as an index of treatment rather than of diagnosis. From the view point of diagnosis, however, the cases studied had shown the following percentage of positive Wassermann tests: 45% in optic atrophy, 41% in keratitis, 23% in iritis.

Dr. J. A. FORDYCE, from the **syphilologist's** point of view, stated that, since the Wassermann reaction had been sup-

plemented by spinal fluid examinations a new view point had been given us as to the pathological conditions which cause the various eye muscle paralyses that so frequently precede some of the serious types of neurosyphilis. Instead of the vague expression "nuclear affection" or degeneration which was formerly in vogue as an explanation we now find positive phases in the fluid which indicate involvement of the meninges. A negative Wassermann reaction may occur in certain focal eye lesions where the complement fixation substance is insufficient or where it does not gain access to the blood stream. In early syphilitic disease of the deep vessels of the eye of a progressive character he has exceptionally found the reaction negative. In such cases active treatment is indicated and may favorably influence the vascular disease. In late vascular syphilis of the eye with a previous history of hemiplegia progressive disease of the chorioretinal vessels may be found with a negative blood and fluid. The vessel degeneration progresses in certain of these cases and may or may not be caused by active spirochætae. Damaged blood vessels with progressive thrombosis offer a possible explanation for therapeutic failures.

In optic atrophy the information gained by examination of the spinal fluid is of inestimable value if properly interpreted and followed by logical treatment. In some of these patients he has been able with the coöperation of his colleagues to follow the changes in the eye grounds over a period of years and to correlate them with the findings in the spinal fluid. In the majority of cases of optic atrophy all phases are positive. A high cell count with a strongly positive reaction, indicating a meningitis about the optic tracts, offer the patient a much more favorable prognosis than a negative or a weakly positive reaction and a low cell count. In the one case we have a definite active pathological condition to treat and in the other a degenerative or end process. It is inexcusable to ignore the spinal fluid findings in optic atrophy as in no other way can an accurate insight be obtained as to what is actually taking place in and about the nerve. Actual destruction of nerve fibers can not be remedied but the organisms causing further invasion and degeneration can often be reached by our remedies and destroyed. In optic atrophy the prognosis as to

possible arrest of the degeneration can be based with a fair degree of certainty on the findings in the spinal fluid. Furthermore permanent arrest of the atrophy coincides in the majority of cases with progressive improvement in the spinal fluid findings.

The value of a positive Wassermann reaction in the blood and spinal fluid as an aid to the clinician in diagnosis and treatment is greater than the value of a negative reaction in excluding a syphilitic condition. The reaction is weakest on the negative side. It has its value in excluding syphilis in types of optic neuritis due to focal infection, in relapsing iritis in late syphilis where other causes than the luetic infection can be evoked and in tuberculous disease of the deep parts of the eye which closely simulates a syphilitic process.

Experimental work with strains of spirochætae shows that organisms recovered from the central nervous system have a special predilection for the eye of the rabbit. Because of this work we have endeavored to ascertain the types of eye syphilis which show nervous system involvement. The majority of our cases of congenital and acquired keratitis have negative spinal fluids. Iritis is usually unaccompanied by fluid changes.

Dr. WARREN COLEMAN, from the viewpoint of the **internist**, said that the Wassermann reaction illustrates perhaps better than any other diagnostic laboratory procedure the pitfalls which beset the man, whether he be serologist or clinician, who fails constantly to keep in mind the fact that the diagnosis of disease rests upon the proper analysis, and grouping, of the phenomena which every disease exhibits, and that there are few diseases in which characteristic symptoms are always present and special tests always positive. Accepting this point of view, it is permissible, almost to regret the development of a new diagnostic test. Diagnostic tests are fertile breeders of carelessness in the study of a patient and his history and the greater the enthusiasm which greets the announcement of a new test, the greater is the danger that it will have this effect. In making hospital rounds, for example, it is so easy to say "have such a test made and we'll make the diagnosis to-morrow" instead of spending the half hour or so required for thorough study of the patient.

As the result of his experience, he has come gradually to

regard it with greater skepticism than any other special test. The Wassermann reaction is not a specific reaction, it is only a special test. Its full significance, and especially its limitations, are not yet known. This is also true even of some specific reactions: certain features of the Widal reaction, for example, being still in dispute. The Wassermann reaction is obtained more constantly in syphilis than in any other disease but is not confined to syphilis. In some typical cases of syphilis the Wassermann reaction is negative, at least for a time. In Bellevue Hospital, Symmers found the reaction had been negative in from 31 to 56% (depending on the antigen) of a series of cases which showed characteristic anatomical lesions at autopsy. Further than this, the reaction may remain strongly positive in patients who clinically have been cured of syphilis by intensive treatment with arsenic, mercury and the iodides. And fatal explosions of cerebrospinal syphilis may occur in persons whose blood Wassermann is negative. The significance of these facts can not be ignored.

In syphilis, as in every other disease, it is hazardous to risk a diagnosis on a single symptom, or physical sign, or even a laboratory test.

Dr. R. E. Pou, from the **neurologist's** point of view, stated that there was very obvious confusion in regard to the Wassermann reaction which leaves the clinician somewhat at sea. On the one hand, in primary and secondary syphilis some observers find evidence of syphilis in eighty per cent., while others contend that thirty per cent. is nearer the truth. This "septicaemia" is usually transitory. Its persistence after the third year is held by Ravaut (quoted by Kaliski) to be evidence of involvement of the central nervous system.

On the other hand, it is well known that many distinct phases of syphilis present no positive findings. Among these, for example, are vascular neuro-syphilis in young people, some cases of gummatous without accompanying meningitis, and certain luetic psychoses, besides occasional cases of tabes, syphilitic epilepsies and spinal involvement of the Erb type. H. C. Solomon has recently made the startling statement that in a given case the results of examination of the spinal fluid from the ventricle, cisterna magna, base of the brain and lumbar sac may differ as to cell count, globulin content, and

the Wassermann reaction. In the light of what we know it is clearly our duty to avoid leaning too heavily upon the laboratory in our diagnosis of neuro-syphilis and to depend more generally upon clinical signs.

From the viewpoint of the **ophthalmologist**, Dr. E. M. ALGER said that the value of the positive Wassermann in ocular disease falls far short of the positive tuberculin test for very obvious reasons, especially because the former shows nothing definite about the eye or the lesion in the eye, although with few negligible exceptions it shows with much certainty that the patient is syphilitic. When the ocular lesion is typically syphilitic (interstitial keratitis) it is confirmatory; when the lesion is doubtfully syphilitic (plastic iritis) it does not by any means settle the question.

The negative Wassermann theoretically ought to be the most valuable of diagnostic tests. Practically it is almost useless, by common agreement. A single negative Wassermann means absolutely nothing. To prove anything, it requires not only several negative blood Wassermann's but also several spinal fluid negatives. Obviously this course can not be a routine, but must be reserved for cases in which there is strong suspicion which can not be cleared up otherwise.

In conclusion he believes the Wassermann test to be an extremely valuable one, but with very definite limitations. It is a test whose value will vary with the serologist who makes it and with its agreement or disagreement with other clinical manifestations of disease. Its interpretation requires intelligence and discrimination, and the worst indictment against it is that it has like other laboratory tests often served as a mental anæsthetic and weakened the intensity of our clinical observation.

Dr. H. W. WOOTTON stated that the symptomatology of syphilitic eye diseases had been so carefully studied before the discovery of the Wassermann reaction that its advent found little to be determined. He doubted whether there was a single important type, certainly none influenced by anti-syphilitic treatment, in which the Wassermann reaction had caused a radical change in our knowledge of the ætiology. It was pleasant to have the agreement of the Wassermann but nevertheless, so far as he was concerned, a violent plastic iritis,

a paralysis of an ocular muscle, choroiditis with opacities at the posterior pole, an interstitial keratitis with the so-called "salmon patch" would all receive anti-luetic treatment whether the Wassermann was positive or negative. In some of the deeper affections of the uveal tract in aiding in the differentiation of syphilis and tuberculosis, he thought that the Wassermann reaction was sometimes of real diagnostic value, but, in general, he regarded it simply as an interesting symptom of syphilis, one not always reliable unless strongly positive and certainly, in hardly any syphilitic eye disease, the most important.

DISCUSSION: Dr. M. J. SCHOENBERG regarded the value of the Wassermann test as dependent upon two points:

1st. How much information is gained as to whether the patient is syphilitic.

2nd. How can it tell us whether the lesion we are dealing with is syphilitic in cases with 4+ Wassermann.

He believes the first point is generally and definitely accepted, but on the second point he thinks the positive reaction does not help the diagnosis in this group of cases, and that one of the most important problems is to recognize non-syphilitic lesions in syphilitic patients.

MEETING OF APRIL 17, 1922.

DR. J. M. WHEELER, CHAIRMAN.

The first paper of the evening, entitled **The Filtering Scar**, was presented by Colonel R. H. ELLIOT, of London and is published in full in this issue.

DISCUSSION: Dr. JOHN E. WEEKS spoke of the point of safety from infection. Should one make a thin conjunctival flap that extends well on to the cornea as in the Elliot operation, or should one make a thick flap which does not extend on to the cornea as in the Lagrange operation? He referred to two cases of late infection in his experience with the Elliot operation, the number of cases being about sixty, where the vesicle had become infected through rupture and the eye lost. The question seems to be, shall we make a scleral fistula or a sclero-corneal fistula. In 450 Lagrange operations he had seen no secondary infections.

Dr. ARNOLD KNAPP said that Colonel Elliot had touched

upon a very important point in the fistulization operation, viz., that the dissection should be clean and done with a minimum of trauma. It was reasonable that the less the epibulbar tissues are interfered with the better they will drain. He was interested in Col. Elliot's observation that closure of the fistulous tract may result from a toxic condition of health on the part of the patient. He had recently observed a case which bore out this relation.

The important question in these fistulization operations is the subsequent safety of the eye. Col. Elliot believes that this can be accomplished by the proper fashioning of the flap, but it is not unusual to find the greatest variations in the amount of subconjunctival tissue, and try as hard as one can to get a thick flap, a vesicular, bleb-like conjunctiva results. He asked Col. Elliot to tell us what, in his opinion, are the pathological factors which lead to this condition and what had best be done after it has occurred.

Dr. H. W. WOOTTON stated that, as a rule, he thought, most operators now made their flaps large and thick and for this reason perhaps, vesicular cicatrices were not so often seen as formerly. He had had two late infections. One occurred two years after trephining for buphthalmus and in this case, of necessity, the conjunctival flap had been thin. The second took place about one year after trephining for simple glaucoma and, unfortunately, in the eye in which the patient had the better vision. In the future he would pay particular attention to having the trephine aperture free throughout its whole extent, the importance of which Col. Elliot had so carefully emphasized.

Dr. J. GRAY CLEGG referred to the importance of cleaning the trephine opening of iris tissue and other debris in order to insure proper filtration. He emphasized also the importance of knowing the general condition of the patient. In 500 trephine operations he had experienced two or three infections, therefore he felt that a thick conjunctival flap to avoid vesiculation was essential.

Dr. W. E. LAMBERT asked in what class of cases is the trephine contra-indicated? He had seen one late infection one year after operation, but treatment had averted disaster.

Colonel ELLIOT in reply to the discussion stated that it was

not difficult to get a thick corneal portion of the scar, for the cornea can be readily split in order to place the trephine opening in the proper position.

He ventured to suggest that late infection follows any filtering scar after any operation. Frequently a filtering trephine scar goes through acute conjunctivitis without infection of the globe. He now sees fewer vesicular scars because he makes the conjunctival flap as thick as possible.

He does the trephine in all cases except secondary glaucoma after cataract extraction and where vitreous is present in the anterior chamber (dislocated lens).

Dr. E. GALLEMAERTS (Brussels), presented the subject, **Microscopic Examination of the Living Eye.** He illustrated the way in which he used the slit lamp, and showed lantern slide demonstrations of his studies.

DISCUSSION: Dr. A. GULLSTRAND congratulated Dr. Gallemaerts upon the difficult and elaborate work he had accomplished.

Dr. Gullstrand pointed out the importance of examination of the anterior segment of the eye under magnification, and referred to the binocular magnifier which he had perfected by adapting the instrument to the particular individual. The instrument has a field diameter of 50mm, and can be used at a distance of 25cm. Where the operator is ametropic, the focusing pieces are fitted into his particular refractive correction, thereby giving satisfaction for distance as well as making minutely clear details at 25cm. He also spoke of the multifocal lens, and stated that where the difference in focus was 1½ D., it required sometimes two months before one becomes accustomed to it, but then they were found to be quite satisfactory.

The English translation of Dr. I. BARRAQUER's paper, entitled **Phakœrisis—Its Advantages and Important Details of Technique** was read by Dr. JOHN O. MCREYNOLDS of Dallas, Texas. This paper is published in full in this issue.

DISCUSSION: Dr. ARNOLD KNAPP stated that extraction in the capsule is undoubtedly the ideal operation which will be universally adopted as soon as a safe method of dislocating the lens in all cases is discovered. Those who were fortunate enough to see Dr. Barraquer operate during the past week

must have been impressed with his dexterity and his success in extracting the cataract in the capsule, and it would seem that this method had solved the problem before us.

If Dr. Barraquer's procedure proves a safe method to dislocate the cataractous lens, the inventor has contributed an epoch-making chapter to the history of cataract operation.

Dr. C. E. McDANNALD complimented Dr. Barraquer upon the success of his method, and spoke of the ideal result where conditions are best suited for the operation.

Dr. W. E. LAMBERT congratulated Dr. Barraquer upon his skill as an operator, and referred to Dr. V. H. Hulen of California who had devised a similar instrument and method of extraction, with some success.

Dr. Lambert spoke of the generally good results from the five cases recently operated upon at his clinic in which he was pleased to assist Dr. Barraquer in the demonstration of his method.

Dr. J. O. McREYNOLDS stated that the discussion of this paper involves not only the particular method employed by Dr. Barraquer but incidentally it touches the entire subject of intracapsular removal of the lens.

In order to obtain a wide range of opinion he had recently sent out to about five-hundred leading ophthalmic surgeons two questionnaires embracing thirty items of inquiry. The responses to these questions combined with impressions gained from his own experience and observation with the Barraquer method as well as the Smith method and still other methods that are found in ophthalmic literature, have led him to conclude that the overwhelming proportion of American Ophthalmologists would prefer to have the lens removed in its capsule provided this did not involve any increase in the hazard of the operation. However, they feel that their opportunities for extensive work in cataract would not justify them in abandoning an operation that had been reasonably satisfactory in their hands for another with which they have not had adequate experience. And they are not likely to adopt any method that cannot be established as an improvement in the matter of safety although some operators of wider experience may attain superior success by a modification of the prevailing procedure.

An analysis of the entire subject would seem to indicate the following features:

If a cataract is removed smoothly in its capsule without undue disturbance of the vitreous, with an accurate adjustment of the pillars of the coloboma if an iridectomy has been made, with an adequate conjunctival flap which may or may not be sutured or left uncut as a bridge, the probabilities are that the patient will secure the maximum amount of visual acuity and comfort, and the minimum amount of reaction and detention from his usual avocation. But we must admit that all forms of intracapsular operations are technically more difficult and that there is likely to be more cases of vitreous loss than by the capsulotomy method. However, whatever complications may occur are almost sure to occur on the operating table while the patient is under control, and vitreous loss with the lens out in its capsule is a much simpler situation than vitreous loss in the presence of retained capsule and cortex.

Dr. J. GRAY CLEGG (Newcastle) said he had seen many of these operations in London as well as those of Dr. Barraquer, and that undoubtedly "it is the last word" so far as complete cataract extraction is concerned.

Dr. I. BARRAQUER in reply to the discussion stated that, while he finds it to be the ideal operation, he wishes to remind all that it is most difficult and not wholly satisfactory to operate as he has been compelled to do recently under strange conditions, upon strange patients (foreign to him), some of them not carefully studied before operation, others even of complicated cataract.

MEETING OF MAY 15, 1922. DR. J. M. WHEELER, CHAIRMAN.

Dr. ALEXANDER DUANE demonstrated in some detail a simple clinical test for light sense (Percival), and showed a small hand motor suitable for making the test.

DISCUSSION: Dr. CHARLES STEVENS asked if the test depended upon a certain rapidity of the revolution of the motor. Dr. Duane stated that the test was best made when the revolution is not too rapid.

Dr. JOHN GUTTMAN inquired if it could be used as a color test. Dr. Duane replied that its purpose was to test light sense.

Dr. JOHN E. VIRDEN asked what distance from the eye the instrument should be placed. He replied that it should be placed so that there appears no flashing reflexes on the color object.

Dr. ALEXANDER DUANE also presented **a new table showing accommodation at all ages.** The table demonstrated the maximum and minimum limits as well as the mean range of monocular accommodation at all ages, based on examinations made on 4200 eyes. As an addendum it contains a note on the comparison between the monocular and the binocular accommodation, deduced from a study of 500 cases.

DISCUSSION: Dr. SINCLAIR TOUSEY asked if Dr. Duane had had occasion to note, in his studies on accommodation, what effect repeated X-ray exposure may have upon the accommodation. This had occurred to him because in his own case he seemed no longer to have any accommodation whatever and could not account for it otherwise.

Dr. Duane had made no observation of this kind.

Dr. LEWIS CRIGLER read a paper entitled **a simple operation for pterygium**, and presented two drawings to demonstrate the character of the operation.

Dr. ARNOLD KNAPP presented a patient who had been operated upon in 1914 for **primary tumor of the optic nerve**, with preservation of the eyeball (reported in the ARCHIVES OF OPHTHALMOLOGY, 1915).

To-day the eye appears like a normal eye. Motility is normal. There is no protrusion or any indication of an orbital return, nor are there any indications of an intracranial process. The eye-ground of the other eye is normal.

The case is of interest as showing the benignancy of these primary tumors of the optic nerve, as in this case the process at operation seemed to extend within the optic nerve sheath beyond the apex of the orbit. There are now no evidences of a further growth.

Dr. ARNOLD KNAPP presented the post-mortem findings from the **autopsy in the case of a child with glioma of the retina of both eyes.** The metastases involved the periosteum

of the external surface of the skull; the external surface of the dura; the thoracic side of all of the ribs with the exception of two; there were some nodules in the liver and a large gliomatous mass occupied the region of the optic thalamus, a direct extension along one optic nerve, which was enlarged. A full report will be published.

DISCUSSION: Dr. J. M. WHEELER asked if the central artery of the retina had been resected. Dr. Knapp replied in the affirmative.

Dr. G. W. JEAN stated that since glioma is bilateral in twenty-five per cent. of cases, the fundus of the fellow eye should be thoroughly examined. He believes that evisceration of the orbit will some day be the primary operation of choice in these cases, in view of the frequency of recurrence. Furthermore, it seems advisable that at the same time a brain surgeon also should attack these cases from within the brain, which they can do with reasonable safety.

Dr. KNAPP remarked upon the interest which the case presented, that autopsy of these cases is rare; Dr. Ewing, who performed this one, had never before done an autopsy on a case of glioma of the retina.

Dr. W. B. WEIDLER reported a case of **solid œdema of the face and eyelids**. Miss V. G., aged 20, Spanish. Family history negative. Measles at five years of age, followed by keratitis which was treated over a period of years. Seven years ago she had an attack of what was diagnosed as facial erysipelas, and since then has had recurrent attacks. She has had trouble with her nose, extending over a long period of years, even before the first attack of erysipelas. The swelling of the cheeks and eyelids which followed the first attack of erysipelas, and which has gradually increased, has at no time entirely disappeared.

March 31, 1922. Examination: Pupils, accommodation, convergence, and tension were normal. Both cornea were more or less densely opaque, due to keratitis at five years of age. Vision O. U. = counts fingers at 8 feet. Peculiar swelling of the cheeks and upper and lower lids to pronounced degree. Skin had a normal color and the texture unchanged. The swelling gave a sensation of hardness, but no pitting on pressure, more marked in the upper and lower lids, and which

has the appearance of a blepharochalasis, but blepharochalasis, as is known, only affects the upper lids. A dense scar tissue formation in front of the right ear suggests a keloid. Behind the left ear, over the mastoid, several keloid-like scars together with a swelling, bluish-red in color, appear to be filled with cheesy material. Patient said she had had a number of these swellings which burst and discharge their contents and are followed by scars. The Wassermann and urine tests were negative. A Von Pirquet test was mildly positive.

Serum taken from the face, grown on agar, showed the presence of staphylococcus albus, which were most likely absorbed from the nose or sinuses. A culture from the nose revealed the presence of a very free growth of the staphylococcus albus together with the short chain streptococcus non-hemolyticus. A vaccine was made and the injections were given, together with the tuberculin for the corneal condition.

DISCUSSION: Dr. WM. M. LESZYN SKY asked if there was a pathologic extravasation into the tissues of the face in this disease. Dr. Weidler stated that the pathology of the disease was not clearly understood; no lymphatic changes had been noted by any observer.

Dr. A. E. DAVIS asked about the Wassermann test and if a T. O. diagnostic test was made. Dr. Weidler had not done the T. O. diagnostic test. The Wassermann was negative.

A case of **melanosarcoma of the lower lid** was presented by Dr. H. H. TYSON. W. V. E., male, age 37 years, had noticed a thickening of the skin on the margin of the outer third of the right lower lid for a considerable time. About six months before, enlargement of the growth occurred, but pigmentation upon the edge and inner aspect of the palpebral conjunctiva was not noticed until about April 6, 1922. Diagnosis of melanosarcoma was made and he was referred to Dr. Fordyce for an opinion. Dr. Fordyce considered it clinically a pigmented epithelioma, although stating it to be potentially a melanosarcoma; and advised its removal by the high frequency spark and electrolytic needles. As with this method the liability of inducing metastases is diminished, it was used on April 19th, and a V-shaped portion of the lid sloughed off, which has been replaced by granulation tissue, leaving very slight disfigurement.

A case of **asteroid hyalitis with thrombosis of the central vein** of the retina was reported by Dr. A. S. TENNER. A man, aged 60 years. History of two attacks of "stroke" from which he had seemingly completely recovered. Two months before he became suddenly blind in the left eye. Vision of the right eye = $\frac{2}{200}$ improved to $\frac{1}{20}$; vision of the left eye = fingers at one foot. Fundus of the left eye presented an apoplectic retina. Disk margins were obscured by hemorrhage so that only the central half was visible. In the vitreous were innumerable bright spots, globular, oval, or pear-shaped.

Verhoeff had reported a case associated with retinal hemorrhage. Holloway had referred to a similar case. The association of this case with thrombosis of the central vein of the retina was of interest in this regard.

Dr. A. S. TENNER read the report of a case of **post-neuritic atrophy** of the optic nerve in a case of tabes, adding a few remarks on the differential pupilloscope in connection with this case.

DISCUSSION: Dr. M. J. SCHOENBERG stated that optic neuritis is rare in tabes, and first one must make certain the optic neuritis is not due to some other cause. Here we meet again the problem so difficult to solve,—how to make a diagnosis of a non-syphilitic process in a patient with syphilis.

Regarding the pupilloscope, it promises to be of great value for measuring pupillary reactions and for localization of pathologic lesions along the optic paths.

Three cases of **hypertension after cataract extraction relieved after removal of focus of infection** were presented by Dr. I. A. HINSDALE and Dr. BEN WITT KEY.

CASE I.—J. E. (#27817), male, aged 76 years, admitted to New York Eye and Ear Infirmary, July 27, 1921. Mature senile cataract, O. D. Vision: fingers at one foot. July 27th, preliminary iridectomy. Four weeks later uncomplicated extraction by Dr. C. Shannon (house-surgeon). Six days later violent cyclitic reaction,—intensive treatment—and discharged in one month. Readmitted one month later,—low-grade iritis, dense secondary membrane and hypertension. De Wecker by Dr. Key. Discharged in ten days, eye quiet. Readmitted in twenty-eight days with similar condition as above. Wassermann, X-ray, and other laboratory tests having

been negative, removal of teeth with infected roots followed by gradual but definite improvement and tension reduced to normal. December 9th, eye quiet, vision $\frac{3}{5}$ with correction.

CASE II.—F. W. (# 1700), male, aged 56 years, admitted to Infirmary November 4, 1921. Mature senile cataract, O. D. History: Three previous sinus operations. November 4th, preliminary iridectomy. Later extraction by Dr. Key without complication. Discharged due time, eye entirely quiet. January 21st readmitted with low-grade iritis and hypertension. Paracentesis performed without permanent effect. All tests having been negative, exenteration of the ethmoidal sinuses revealed polypi and pus. Almost immediate improvement in the ocular condition and tension in five days reduced to normal, and has remained so to date.

CASE III.—H. K. (# 36889), male, aged 57 years, admitted November 9, 1921. Sclerosed lens O. D. Vision: $\frac{2}{5}\frac{0}{5}$. November 9th preliminary iridectomy. November 30th lens extracted by Dr. Hogan (house-surgeon) with uneventful recovery. Discharged in fourteen days, eye normal as after cataract. Six weeks later low-grade iritis with hypertension. Iridectomy by Dr. Key. Ten days later hypertension recurred. Removal of badly infected tonsils on January 30th, laboratory tests having been negative. February 4th, the eye quieting, tension normal, and vision $\frac{3}{5}$ with correction.

Dr. Ben Witt Key regarded these cases as important in this connection for the following reasons:

1st. Under most careful examination there was no evidence in any of these cases of iris encarceration or prolapse; no tag of capsule blocking the iris angle; no formidable opaque lens substance; no crowding forward of the iris, the anterior chamber in each case being normally deep after extraction.

2d. Low-grade iritis and cyclitis developed with hypertension secondary one month to six weeks after extraction in each case.

3d. Recovery from iritis with restoration to normal tension followed removal of a focus of infection, no other treatment being administered but hot bathing and atropine, other laboratory indications being negative.

These three cases occurring over a period of nine months in the hospital, strikingly similar—clinically and therapeutically

—seem to demonstrate the value of preventing as well as relieving that type of glaucoma secondary to low-grade iritis after extraction, in which perhaps the consistency and character of the contents of the anterior chamber is the mechanical cause, in turn due to a focus of infection of suitable location and virulence.

DISCUSSION: Dr. G. H. BELL stated that studying focal infections is the most important work that is being done in medicine to-day. Every patient should be given the "Acid Test for the Three T's." He emphasized the necessity of studying these cases before operation as well as when complications arise.

He referred to numerous cases of chronic simple glaucoma controlled by removal of foci of infection and regulation of the diet and the habits of life. He further insists upon a "Reform Diet" which consists of not mixing starches and proteids at the same meal, and in reducing the intake of sugars and sweets.

Dr. MARTIN COHEN presented a **Morton electric hand ophthalmoscope** with a green film filter attachment for red free light examination of the fundus.

REPORT OF THE TRANSACTIONS OF THE ANNUAL
CONGRESS OF THE OPHTHALMOLOGICAL SO-
CIETY OF THE UNITED KINGDOM.

BY MR. H. DICKINSON, LONDON.

Industrial Diseases of the Eye.

At the recent Congress held by the Ophthalmological Society of the United Kingdom, an afternoon was set apart for the discussion of industrial diseases of the eye (excluding accidents, miners' nystagmus, and glass-blowers' cataract).

Dr. T. M. LEGGE, C.B.E. (H. M. Inspector of Factories), opened the discussion from the administrative side. He spoke first of intractable conjunctivitis caused by hydrogen sulphide. He saw, on one of his factory visits, a chemist with intractable conjunctivitis, especially marked in one eye. This man periodically applied the eye which was chiefly affected to a little peep-hole where a process of manufacture was going on, and in doing so he lifted up a little piece of glass in order to see better into the chamber, and it was the resultant stream through this aperture which kept up the inflammatory condition. He remembered, too, in the early days of the manufacture of sesqui-sulphide of phosphorus, that the life of a manager was made miserable by the small amount of hydrogen sulphide which was given off into the atmosphere when the sesqui-sulphide came into contact with moisture. This was not relieved until the whole process was carried on under a negative pressure. He spoke chiefly on the optic neuritis set up by lead-poisoning. He exhibited a carefully prepared chart showing the gradual decline of cases of this condition from the time when the instances numbered 1,200 in a year, to the present time, the fatal cases being shown in red. He separated the cases due to encephalopathy from those of optic

neuritis uncomplicated by such manifestations as lead convulsions. He had also indicated those who were suffering from mania or mental hebitude. In the white lead industry there had been a tremendous drop in the number of cases; there was also a large decrease in the paint and colour industry. But there was no corresponding diminution to record in industries in which white lead was used, as in coach-painting or ship-building. Cases occurring in house painting were not compulsorily notifiable, and up to 1914—the industries were abnormal during the war—there was a steady increase in the number of cases occurring. The diminution of the cases of optic neuritis due to lead in controlled industries was due to the fact that in them an exhaustive system of ventilation by means of fans to take away the dust produced was in operation, whereas the dust caused by sandpapering the dry paint in coach-painting could not be so carried away. The system of ventilation now in operation in the industries referred to did not depend on the workers' power of applying it or omitting to do so. Slides were shown illustrating the method in which this is carried out. A factory which, just before the war, was working for some country intensively on dinitro-benzine, had 28 cases of poisoning by that substance, including 4 of amblyopia. During the summer, owing to the volatility of the substance, a greater number of people were put on to the work in night relays, and these cases occurred in a burst. When the shift was reduced to four hours, the conditions improved. Dr. Holmes, of Wigan, said he had never seen cases with such extreme contraction of the fields of vision. During the war, T.N.T., which caused so much illness in the form of dermatitis and toxic jaundice, did not appear to have affected the optic nerve. Only two cases were brought to his notice, and in regard to these he had the reports of Dr. Patterson, of Edinburgh, who considered the weight of evidence favoured their being due to tobacco, rather than to T.N.T. In reference to tobacco amblyopia, his colleague, Dr. Middleton, followed up the case of a woman, a non-smoker who for 25 years had been employed in the leaf room of a tobacco factory. About nine months before being seen, her vision commenced to be defective. Mr. Sim, of the Edinburgh Royal Infirmary, investigated the case, and he reported that

it was a case of tobacco amblyopia. The woman had been exposed to finely-divided tobacco dust which was produced through a fine-meshed hand sieve.

Dr. Legge exhibited slides showing how, towards the end of the war, 12-inch shells were filled by means of movable flexible pipes, and the means used to carry away the fumes.

He also exhibited slides showing how anthrax affected the eyelids. Before the use of anti-anthrax serum the fatality of external anthrax—which was now normally 15 to 25%—was much worse when affecting the eyelid, especially the upper lid. At that time he considered that 40% to 45% of cases when the upper eyelid was affected would be fatal. Now, however, since the giving of the serum, in 80cc doses intravenously, followed by 60cc on the following day, the mortality of eyelid cases had been definitely reduced, so that the mortality in these cases was now much the same as in those where other parts of the body were involved. External anthrax seemed to be fatal in proportion to the degree of looseness of the cellular tissue at the site of infection; the eyelid was, of course, rich in such tissue. The slides shown were of different stages in eyelid infections.

Dr. Legge asked whether the increase in the long axis of the eyeball, constituting myopia could be regarded as an occupational disease. He commented on the comparatively little work which had been done on the subject of visual fatigue. Did the work, such as that of the compositor, cause myopia, or did that work merely cause special attention to be directed to a defect already there?

Mr. BERNARD CRIDLAND related his experiences in a large iron-workers' district, and exhibited a table of cases with particulars and histories.

Professor COLLIS discussed the relationship between visual acuity and vocational selection. Employers were rapidly coming to see the disadvantages resulting from a worker and his work being ill-mated; output was smaller when that was the case and discontent was generated by seeing his fellow-man earn more than he could earn himself; it accounted for men drifting from place to place in search for a congenial employment. Behind the science of vocational selection lay the earlier science of vocational guidance, which should be in

the hands of teachers and juvenile advisory Committees, who, after ascertaining the capacity of each adolescent, should guide him in that walk of life wherein such capacity was needed and had scope. And no faculty had greater influence on capacity than that of vision, for as we saw, so did we react. Indeed, artistic appreciations must depend on visual acuity and the presence or absence of errors of refraction. Visual acuity was definitely related to industrial efficiency; the need for good vision in the engine driver and the seaman had long been recognized, therefore there was surely need for the vision of all motor-car drivers to be tested. Instances of the latter meeting with accidents were frequent, yet fining and endorsing the licenses seemed to sum up the resultant action, the men concerned being again let loose upon society. He knew of no case in which an offender had been referred to an ophthalmologist to have his sight tested. The Professor elaborated this theme by referring to personal experiences.

With regard to accidents, it had been concluded that 85% of all accidents were due not to absence of guards and safety appliances, but to such causes as negligence, carelessness, want of thought, and, most of all, to a lack of appreciation of danger. And Greenwood had pointed out, as a result of statistical enquiry, that there was a varying individual susceptibility to accident but no one had yet tried to connect such increased tendency with defective eyesight. Nevertheless, the relation between deficient illumination and accidents had been pointed out by Wilson and Patterson in this country, and by Simpson in the United States. The latter authority estimated that out of 91,000 accidents, 23.8% were due to imperfect illumination. Innate imperfect visual acuity might be an important factor in determining individual susceptibility to accident; certainly muscular contraction was less accurate and more liable to error where vision was imperfect. Visual acuity must also affect industrial efficiency. He was not aware that anyone had examined the best and the worst workers in different processes to ascertain their respective visual acuity; yet not until such had been carried out could anything valuable be known of the visual needs for different occupations. There was a great tendency to look after the rare and unusual diseases, which, after all, were but as a drop in the ocean.

With regard to the effect of industries upon visual acuity, certain occupations did produce certain of the eye diseases. Miners' nystagmus (which had been ruled out of this discussion) was associated at one end with very low illumination, and at the other end were cases of cataract caused by excessive exposure of the eyes to heat rays from molten metal. But what was less clear was the effect produced by less pronounced exposure in the ordinary circumstances of work. A necessary preliminary was to know the visual acuity possessed by the general community of the same age as these workers; he knew of no such information, but it was much needed. The closest approximation was that of juveniles of school age, but this could not be applied to adults, especially those of middle age, the age when the effect of occupation was most pronounced. It seemed clear that the human eye was never evolved for the purpose for which it was now so constantly used, and when so used it was found to be a more or less defective organ. How far this use acted injuriously required to be determined, so that acuity and occupation could be effectively mated. He pleaded for research upon the lines he had indicated, so that employers who needed people to work at various processes might know what standard of vision to look for in the people they might choose.

Mr. HEALY referred particularly to tin plate workers' cataract. In this industry he had seen a type apart from the posterior polar variety, and one found the posterior polar variety associated with the cortical variety in the lower cortex. Whatever the cause of the posterior polar variety might be, it was probably also the cause of the broom-like opacity in the lower and inner cortex. He did not think direct rays had much to do with it. He believed that heat rays were absorbed by the iris, and that owing to that continual absorption an alteration occurred in the secreting endothelium, and in that way the aqueous was altered; it might lead to the increased formation of salts in the aqueous, and there might occur spread along the ligament to the lens epithelium, thereby admitting aqueous by osmosis into the lens substance, leading further to swelling of lens fibres, and in that way to the production of cataract. The cortical variety might possibly be produced by some alteration in the essential lymph channel

which reached the posterior pole. He agreed with those who said there should be further investigation as to the effect of manual labor upon the general bodily health. He had in mind the case of a man aged 41, a roller-man in a mill, who consulted him because of homonymous hemianopia, which had come on suddenly. He retained central vision, but the condition never improved. No cause for that man's arterio-sclerosis could be found; his blood pressure was 205mm; his Wassermann, done several times, was negative, and several good physicians failed to find any cause for his arterio-sclerosis. Possibly men who were engaged in hot work such as this and were constantly sweating and imbibing large quantities of fluid, might develop arterio-sclerosis in consequence, and this might be an adjuvant factor in the production of cataract.

He had seen many cases of cataract amongst iron-workers and in them the results after operation were as good as in the general run of the population who had senile cataract.

Dr. BRINTON (of Johannesburg) said that occasionally posterior polar cataract was encountered in gold smelters and assayers, who had to be constantly assaying small samples in crucibles. It was not included in the diseases for which compensation was recognised, but he had got the manager of a large mine to recognise it as a subject for payment. He had never yet encountered a case of cataract from heat in the native possibly because the native had always been accustomed to considerable heat.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

BY MR. H. DICKINSON, LONDON.

A clinical meeting of the Section was held on Friday, 9th of June, under the chairmanship of SIR JOHN H. PARSONS, F.R.S.

Mr. J. F. CUNNINGHAM showed a patient who had a mass obscuring the optic disk. Even under the best conditions the mass could only be seen indefinitely; it involved the disk in its lower part. He thought it was possibly of congenital origin, though it might have followed upon some trauma.

SIR JOHN PARSONS thought it more likely that it was a congenital film, due to an excess of fibrous tissue on the disk, than that it was ordinary retinitis proliferans.

Mr. DOYNE exhibited a case with symmetrical swellings of the lids. As the patient was an inmate of a mental hospital there might be doubt about the history he gave. There were symmetrical swellings towards the outer margin of the upper lid, in both eyes. The patient himself said they had been there ever since birth, and that they had undergone no appreciable change in size. At first he regarded it as a dermoid, but felt sceptical about that later because on pressure it gave a sensation of lobulation, such as from a lipoma. He asked for opinions.

Mr. J. B. LAWFORD thought cystic swellings could be excluded. Under pressure the tumors receded very readily, so that it was difficult to make out their outlines with the finger tips. And against the idea of dermoid was the fact of the swellings having been stationary in size for forty years; he believed orbital or extra-orbital dermoids were never station-

ary, some grew quite rapidly. In his view, the diagnosis lay between symmetrical fatty swellings and a soft form of congenital hydroma. Their extreme softness favoured the former view.

Mr. MALCOLM HEPBURN thought the possibility of it being lacrimal gland should be considered.

Sir JOHN PARSONS said the swellings apparently were similar to those frequently seen in the inner part of the upper lids in elderly people, and which were generally recognized as being due to orbital fat coming through the opening in the facial septum. He was unfamiliar with such swellings in the outer part of the upper lids.

Mr. OLIVER showed some beautifully executed models for *prothesis*.

Sir JOHN PARSONS said these models showed that the work had been brought to the pitch of a very fine art.

Mr. H. R. JEREMY exhibited a woman, aged 38, who had a *retinal detachment at the macula*. A fortnight ago she attended hospital and stated that she had been unable to see with the left eye for two years. When eight years of age, she was struck in that eye with a stone. At times the eye was painful. A fortnight ago she could perceive fingers at the periphery of the field, and now there was only perception of shadows there. The tension of the eye was not raised, there was no conjunctivitis, nor circumcorneal congestion, and the cornea was clear. There were, however, a few fine vitreous opacities. The disk was normal. There was a detachment of the retina at the macula, ovoid and regular in shape, grayish-white in color, and the surface was smooth. A fortnight ago the detachment was 4 or 5 disks in diameter, the edges were regular, and there was choroidal pigmentation below. The tension was raised plus 8 to plus 10. Wassermann reaction was negative. He had advised having the eye removed, but thought he would like opinions of members first.

Sir JOHN PARSONS said that if the detachment started in the macula it was a long history (two years). He referred to a case which was under the care of the late Mr. Marcus Gunn, in which a tiny tumor in the macular region manifested itself at an early stage in the history by a disturbance of the central vision. Examination showed, in the lower part of the fundus,

a large simple detachment of the retina, separated from a very shallow detachment just over the growth.

During the meeting, congratulations were offered to Sir Richard Cruise on the honour just conferred on him by his Majesty in creating him a Knight of the Royal Victorian Order.

NOTES.

OUT-PATIENT WORK IN OPHTHALMOLOGY.

PRELIMINARY REPORT OF ACTIVITIES OF SECTION ON OPHTHALMOLOGY OF THE ASSOCIATED OUT-PATIENT CLINICS OF NEW YORK CITY.

BY DR. CONRAD BERENS, JR., SECRETARY OF THE SECTION.

The Associated Out-Patient Clinics of New York City, organized in 1912 as a federation of out-patient departments of the leading hospitals of the city, together with a number of dispensaries unattached to hospitals, recently resumed activities after an enforced lapse during the war. The dispensaries of the city have grown rapidly during recent years, it being estimated that 1,250,000 persons received dispensary care in New York City during 1921. Hence, the Associated Clinics feel an increasing responsibility to accomplish the purpose for which it was founded, the advancement of the standards and methods of out-patient work and the coördination of the many existing dispensaries and out-patient clinics of the city.

The work of the Associated Out-Patient Clinics is carried out largely through professional committees, representing the chief branches of medicine, surgery, and administration. These sections have developed in past years a body of standards for dispensary service, but the active interest and coöperation of the governing boards of the member institutions is essential in order to make this professional work of practical influence. For this reason, the newly adopted constitution of the Association provides that one of the two representatives of each member institution must be a member of the board of trustees or of the similar governing body. These representatives will

act as channels of communication with member institutions in endeavoring to make the Associated Out-Patient Clinics a coöperative organization for the improvement of dispensary services in New York City.

As many problems represented by out-patient work in ophthalmology were brought to the attention of the Association and it was deemed advisable to call a meeting of the ophthalmologists representing the member institutions of the Association and organize a section on ophthalmology for the purpose of considering these matters. Such a section was organized in January, 1922, at which time Walter E. Lambert, M.D., was elected chairman, Edgar S. Thomson, M.D., vice-chairman, and Conrad Berens, Jr., M.D., secretary. The Executive Committee were appointed as follows: Ellice M. Alger, M.D., Isaac Hartshorne, M.D., P. Chalmers Jameson, M.D., H. H. Tyson, M.D., J. M. Wheeler, M.D., Julius Wolff, M.D., and the officers.

At the several meetings of the Section, consideration was given to various topics, such as:

1. Lack of professional standards
2. Paucity of equipment
3. Overcrowding in all clinics, especially for refraction
4. Abuse of clinic by patients able to pay
5. Failure of patients to secure glasses when prescribed
6. Unsatisfactory financial arrangements with opticians
7. Lack of uniformity of fees charged for admission, drugs, laboratory examinations, glasses
8. Lack of provision for research
9. Incompleteness of records and inadequacy of filing system

The Section decided that no official pronouncement on these matters would carry weight unless sufficient facts were gathered upon which to base recommendations. The Executive Committee, therefore, outlined the research which was considered necessary and the following studies were made: Conrad Berens, Jr., M.D., assisted by Ray R. Losey, M.D., made a study of professional methods, equipment, records, teaching, and research in nine institutions (New York Eye and Ear, Brooklyn Eye and Ear, Knapp Memorial, St. Luke's, Post-Graduate, Vanderbilt Clinic, Manhattan Eye and Ear, Cornell Dispensary, and Health Department Clinic P.S. No. 30.) In-

formation was also secured as to the practice in these matters in representative clinics in other cities. A series of records was studied at each institution to ascertain their completeness from a scientific standpoint.

Studies of the admission procedure, fee systems, and the provision of glasses in four special eye clinics and eight eye clinics in general dispensaries were made by Gertrude E. Sturges, M.D., of the staff of the Associated Out-Patient Clinics.

In order to ascertain the need for systematic follow-up systems in eye clinics, a study was made of 5200 records from five representative clinics. The number and proportion of cases which might lead to blindness was determined and the care and disposition of these cases by the clinic was considered.

A summary of the findings of the studies together with the conclusions and recommendations arrived at by the Committee as a result of these findings will be presented in the report of the Section which will be available in the fall.

ARCHIVES OF OPHTHALMOLOGY.

THE EARLY DEVELOPMENT OF THE CORNEAL TUBERCLE. (A STUDY IN SLIT LAMP MICROSCOPY.)

BY DRs. BERTHA T. HAESSLER AND F. HERBERT HAESSLER.

(From the Henry Phipps Institute of the University of Pennsylvania,
Philadelphia.)

EXPERIMENTAL tuberculosis of the cornea has been studied repeatedly and both the gross and microscopical appearances of the lesions have been accurately described. In 1877 Cohnheim and Salomonson (1) inoculated tuberculous matter into the anterior chamber and called attention to tuberculosis of the iris and cornea. Haensell (2) in 1879 inoculated the pus from tuberculous joints into the cornea of rabbits and guinea pigs, and describes the gross and microscopic appearance of the lesions which, in his cases, all went on to complete healing. Panas and Vassaux (3), in 1885, likewise gave an accurate picture of tuberculosis of the cornea with healing, gross and microscopic. They passed tuberculous sputum through guinea pigs and used the ground-up tubercle, which was introduced into the cornea with a vaccine stylet. Kostenitsch and Wolkow (4), in 1892, used pure cultures of the tubercle bacillus for the study of experimental tuberculosis of the cornea, anterior chamber, and vitreous. Their work is almost entirely a histological study of the cellular reactions to the tubercle bacillus. In 1896, Heydemann (5) published an

extensive dissertation on tuberculosis of the cornea with a thorough review of the literature on the development of the tubercle. He described both gross and microscopic changes. The first reaction was observed to occur at the end of ten to fourteen days, and healing eventually took place in all cases. Schieck (6), in 1896, gave a detailed and interesting account of the first stages of experimental tuberculosis of the cornea of the rabbit, as observed in microscopic sections, with an introductory discussion of the literature. Bach (7) likewise described tuberculosis of the cornea both clinically and experimentally, and found that if a deep corneal inoculation was made, tubercles developed more slowly than after superficial inoculation. He saw a secondary involvement of the iris in only one instance. Krusius (8), in 1911, did considerable work on experimental tuberculosis of the eye. He attempted to obtain quantitatively comparable results by using large series of similar animals, with one culture of constant virulence. The quantity of organisms was standardized by emulsifying dry bacilli in salt solution and making dilutions with large differences made of the same emulsion. He inoculated his emulsions into the corneal substance, and used a corneal microscope as an aid to his observations. He concluded that the incubation period in a given case is inversely proportional to the quantity of the infection, with an upper limit at which the incubation period equals zero and a lower limit where it equals infinity. He states that only in the rarest cases do the bacilli enter the general circulation. He found, by using quantitative inoculations, that the susceptibility of the eye to tuberculosis was, decreasingly as follows: vitreous (most susceptible), aqueous, cornea, conjunctiva, and lens. Krusius, as well as all the other workers here quoted, obtained healing in practically all the cases studied.

Lewis and Montgomery (9), 1914, published a paper entitled "Experimental Tuberculosis of the Cornea," and it is on this work that the present study is based. Our study was undertaken at the suggestion of Dr. Lewis with the idea that something might be added to the observations of the gross development of the tubercle by the aid of the corneal microscope with slit lamp illumination. The technique of inoculation is that described by Lewis and Montgomery, namely, injection into

the corneal stroma of an emulsion of tubercle bacilli by means of a small record syringe and a number 26 platinum needle with a very short bevel and a sharp point. Rabbits were used exclusively and the eyes were well cocainized before inoculation. Grossly the lesions developed as described by Lewis and except where a known avirulent organism was used, healing at no time occurred. The animal eventually succumbed to a generalized tuberculosis. Emulsions made of pure cultures of bovine strains of known virulence were used in all cases.

In the majority of the animals our studies were limited to the early changes—those occurring during the first, second, or third weeks after inoculation—as we found that it was here that the slit lamp and corneal microscope were of the greatest help.

The Gullstrand slit lamp is an instrument that has increased the field of usefulness of the microscope for observing the living eye, not because its light is more intense but because it is corrected so that only a narrow accurately delimited beam of light is focussed onto any structure of the eye, while other parts remain in relative darkness. The contrast between the illuminated and contiguous unilluminated areas then permits microscopic study of fine details which had previously escaped observation.

The source of light is a small, closely wound Tungsten spiral enclosed in a nitrogen-filled bulb. A condenser consisting of two plano-convex lenses, placed with the convex surfaces toward one another, projects an image of the spiral into the diaphragm of the objective lens—plano-convex with the convex surface toward the light—of 7cm focal length, which condenses the light to form an evenly illuminated surface less than 1mm wide.

In the model of the Gullstrand slit lamp manufactured by Zeiss, the lamp is mounted independently on an extensible stand. The eye can be observed with the Czapski corneal microscope similarly mounted, and magnification varying between eight and one hundred and eight diameters may be used. The oscillation of the living eye precludes the use of higher magnification than this.

This armamentarium makes it possible to scrutinize the individual cells of the endothelial layer of the cornea, to see

single cells and agglutinated masses of cells in the aqueous humor, to see circulation of blood corpuscles in the finest capillaries, to see nerves in the cornea, to see structures in the vitreous, and to localize precisely the position of structures observed in the clear media of the eye.

Our studies may be roughly divided into two groups; one, the early development of the corneal lesion in healthy rabbits, which constitutes the major portion of the work, and second, the early changes observed in the eyes of animals previously inoculated with small doses of tubercle bacilli and, therefore, suffering from tuberculosis. These we hope to discuss in a second paper.

After the work was well in progress, white rabbits only were used. Slight vascular changes were found to be easier of detection in albinos and changes occurring at the limbus as well as in the iris were better seen. The rabbits weighed from 1500 to 2500gms and in each case the eyes were carefully examined with the slit lamp and microscope before inoculations were begun. Aside from tubercle bacilli, of which two virulent and one avirulent strains were used, comparative studies were likewise carried out on a small number of rabbits with, first, a virulent twenty-four-hour culture of staphylococcus aureus and, second, an emulsion of mercury sulphide in water. In so far as possible, these have been correlated with the main problem.

First Changes Observed.—Of the twenty-six rabbits studied, the first pathological change was observed four days after inoculation in twelve rabbits, three days after inoculation in seven rabbits, two days in three, and in one case each, five, eight, nine, and eleven days after injection. The time depends not so much on the virulence of the culture used as the method of inoculation and the number of bacteria introduced. In all cases where reaction occurred after the fourth day, the culture used was a virulent bovine strain. A superficial scratch and a weak suspension were used in the rabbits that showed the first change on the fifth, eighth, and ninth day respectively. In the case where the reaction occurred on the eleventh day, a deep inoculation of a virulent culture was made. No explanation for the delay can be offered except that of the varying susceptibility of different animals.

In the great majority of rabbits, the first change observed was a very faint injection of a leash of conjunctival vessels at the limbus. In the white rabbits, there could always be seen at the same time a pronounced acceleration of the circulation at the limbus. Not only were the vessels dilated but the blood flowed through them with much greater rapidity. In all the white rabbits where a virulent strain of bacilli was used, an injection of the small vessels of the iris preceded or accompanied the limbus hyperæmia. This early injection of the iris vessels was noted by Schieck in his studies in 1896 (*Schieck-Ziegler's Beitrage*, xx., p. 275). In the brown-eyed rabbits this change was overlooked, or possibly impossible of detection on account of the pigment of the iris. In no case of tuberculosis were cells seen in the aqueous preceding the vascular dilatation, though they were often seen simultaneously. When *staphylococcus aureus* was used, on the other hand, the cellular exudation was much more pronounced than the vascular reaction. In these cases, circulation could not be studied due to the intense oedema and clouding at the limbus. In the rabbits injected with *staphylococcus aureus* the first change was noticed in twenty hours, and probably was present even earlier. It consisted of an intense vascular injection together with oedema and severe purulent exudation.

Four eyes were injected with mercury sulphide, two of them, where larger amounts were used, showed injection of the vessels of the bulbar conjunctiva within twenty-four hours. In the other two, where smaller amounts of mercury sulphide had been used, the first change was noted on the fifth and sixth day respectively, and consisted of a very slight bulbar injection accompanied by cellular exudation. In none of the eyes where mercury sulphide had been injected was there a pronounced acceleration of the circulation at the limbus.

Cellular Exudation.—The study of cellular exudation proved to be of special interest. Cells are seen in the aqueous in the dark area between the two beams of light reflected by the cornea and iris respectively, and appear as bright glistening bodies (Tyndall effect). When the anterior chamber is very full of cells, the impression is that of a snow fall in a heavy wind. Cells on the lens surface appear as small whitish dots under the lower power, somewhat as white blood cells in the

counting chamber. Under the high power, the cells look white and perfectly round, with a homogeneous protoplasm. It is generally impossible to distinguish a nucleus. It is always easy to tell whether a deposit consists of one single cell or of an aggregation of cells stuck together. Pigmented cells are about two to three times as large as white cells.

On the iris, cells are seen with difficulty and only when they are very abundant can they be made out as small grayish-white bodies. Cellular deposits are readily seen on Descemet's membrane by focusing the microscope through the dark side of the prism which the slit lamp cuts out of the cornea. They appear as single or multiple white dots.

An exudation of small white cells, with a small admixture of larger pigmented cells in the brown-eyed rabbits, occurred anywhere from the third to the eighth day after inoculation. At times a few cells—not more than six—were seen on the lens as early as forty-eight hours after the injection. In 50% of the cases, cellular exudation was first seen on the fourth day. The cellular reaction was in all cases accompanied by hyperæmia of the bulbar conjunctiva. In some cases this hyperæmia preceded the exudation of the cells by twenty-four hours.

The extent, duration, and character of the cellular exudation differs depending on whether a virulent or relatively avirulent strain of tubercle bacilli is used. In the case of a virulent culture, the eye which has been entirely normal at the preceding examination, grossly shows a slight bulbar injection, accompanied or preceded by an intense injection of the small vessels of the iris. Microscopic examination shows the aqueous densely filled with small white cells. These cells are all single and float through the aqueous irregularly; in some cases there is a tendency to drop down into the chamber angle. A large number of cells settle out on the anterior surface of the lens. On the first day the lens is simply peppered with cells without any definite arrangement. On the following day or days there is often seen a distinct tendency to group formation, the denser grouping usually taking place toward the periphery of the lens. Later there is an agglutination of a number of cells which float free in the aqueous or adhere to the lens surface. The clumps may consist of only three to four cells, loosely adherent, or of ten to twelve, or more. In five cases a few clumps were

observed on the first day that cells were seen; in four cases, twenty-four hours later; in two cases forty-eight hours later; in two cases four days; and in one case six days after cells had first appeared. In all the cases that progressed to destruction of the eye, a grossly visible hypopion was eventually formed which consisted of piled up cells in the lower angle of the chamber. Whenever hypopion was seen it was associated with an aqueous full of cells.

Cellular deposits on Descemet's membrane were seen easily when a virulent culture was used. In five cases these deposits occurred on the same day that cells were first observed, in the other cases they were seen two to eight days later. In most cases these deposits were first noticed in the most dependent part of the cornea as distinguished from the deposits on the lens, whose distribution was entirely irregular. Special note should be made of one case where the deposits on Descemet's membrane were definitely grouped about the lesion at the site of inoculation. The opacity roughly vertically bisected the pupil. The lowest part of this opaque area was heavier than elsewhere and it was in opposition to this portion that the cellular deposits were grouped. The deposits were largest and most numerous just beneath the opacity and became progressively smaller and less numerous in the surrounding zone. They could not be seen with the microscope by illumination other than that of the slit lamp, nor were they visible with a + 16 or a + 7 lens of the ophthalmoscope.

When a relatively avirulent strain of bacilli is used, the primary result is practically the same, provided the emulsion of organisms is a sufficiently heavy one. A thin emulsion produces either no reaction whatsoever, or at most calls forth a very small number of cells. When a heavy emulsion is used, the aqueous and anterior surface of the lens are peppered with cells three or four days after inoculation. Within twenty-four to forty-eight hours all cells have disappeared from the aqueous and only a few are left on the lens surface. None are at any time found on Descemet's membrane. Cellular studies with an avirulent culture were carried out on six rabbits. In three of them the disappearance of the cells from the aqueous closed the pathological picture and the eye returned to normal. In three other rabbits short strands of new-formed vessels de-

veloped on the cornea. In two of these cases the vessels appeared twenty-four hours after the cells were last seen in the aqueous; in the other case the corneal vessels were first seen on the last day that the cells in the aqueous persisted. Clumping together of the cells was observed in all these cases on either the first or the second day after the cellular reaction began.

Cellular Reaction with Staphylococcus Aureus.—For the sake of comparison, two rabbits were inoculated intracorneally with an opaque emulsion of a twenty-four-hour culture of staphylococcus aureus. Within less than twenty-four hours there was a thick purulent exudation from the eyelids and the entire cornea was grossly dull. The aqueous was packed with white cells, as was also the lens surface. Many of the cells formed loose clumps. Some of them were adherent to Descemet's membrane. The following day the eye grossly looked much less angry. In one of the rabbits the cells had, to a large extent, disappeared, a moderate number of single cells remaining in the aqueous and on the lens surface. In the other rabbit the cells disappeared less rapidly. For two days the aqueous was packed with cells which settled out to form a hypopion. Three days later, however, this could no longer be seen, nor did any cells remain in the aqueous or on Descemet's membrane. Both rabbits showed a sprinkling of white cells on the lens surface which persisted until three weeks after inoculation.

To determine the part played by mechanical irritation only, four eyes of normal white rabbits were injected with mercury sulphide—a finely granular red powder. It is impossible to control the exact amount of material injected and it so happened that two of the eyes received a large injection, while in the other two a moderate amount only was introduced. In both eyes where the mercury sulphide was in heavy suspension, there was a bulbar injection within twenty-four hours and an occasional cell was seen on the lens. On the second day in one eye, on the third in the other, the anterior chamber was densely filled with cells and cells were seen on the lens, at first single, one to two days later in clumps, then single again just before their disappearance, one week after inoculation.

In the two rabbits where smaller amounts of mercury sul-

phide were introduced, the first reaction occurred on the fifth day in the one, and on the sixth day in the other. In both these cases the cellular exudation, together with a very faint bulbar injection, was the first sign of pathological change. The first rabbit at no time showed any injection of the conjunctiva or iris vessels, dulling of the cornea or other changes. Had the cells not been seen with the microscope, the eye would have passed as normal. Forty-eight hours after the primary exudation, clumped cells were seen in both rabbits, chiefly on the lens surface. Three days later all cells had disappeared from the lens and aqueous in the one rabbit, and only a faint sprinkling on the lens was seen in the other.

New Formed Vessels.—The formation of vessels is perhaps the most characteristic of the lesions seen in tuberculosis of the cornea. Its gross features have been accurately described by various investigators (2, 3, 5, 8). The earliest vessels are always observed at the limbus above, no matter where the corneal injection is made. These vessels usually attain a greater length than those coming in from below or from the sides, and eventually extend into the opacity at the site of injection. In the most advanced stages the entire cornea may be vascularized.

The new-formed vessels are generally first seen on the fifth to the seventh day. Occasionally the earliest strands can be detected on the fourth day, in one case they did not appear until the ninth day and in two until the eleventh day after the inoculation was made. In these latter cases, however, the incubation period has been unusually long. As a general thing it may be said that the earliest vascular shoots on the cornea are seen two to three days after the first signs of reaction have occurred. These shoots develop as short strands coming off from the superficial conjunctival vessels at the limbus and lie superficially on the cornea throughout their course, forming a sort of fringe at the limbus. At the time of their origin the cornea underlying them is clear. After 2-3 days of an irregular central-ward growth, strands of these vessels meet to form capillary loops, through which an exceedingly active circulation is maintained. As the vessels became larger they assumed a broom-like growth and increase in width as well as in length. The vessels just above the site of inoculation are of the greatest

length and eventually extend into the opacity, while the other vessels have formed short loops only.

When a virulent culture of tubercle bacilli is used the vessels develop more rapidly than when an avirulent strain has been injected. In the former case the vessels within three or four days become so large and the cornea becomes so dull that further slit lamp study is impracticable. Blood vessel formation is best studied when an avirulent culture is used and very short strands develop on a clear cornea. When the straight shoots first form, no circulation can be seen in them, but as soon as the strands are joined into loops, active circulation begins. From other loops further strands develop while the primary trunks increase in size. At most a small fringe of capillaries is visible to the naked eye and the vessels never reach into the inoculation site. When the avirulent strain is used, when healing begins, the circulation through the capillaries gradually becomes much slower and soon the vessels are grossly invisible, though microscopically they are still seen to carry a fine current of blood. The smallest capillaries permit the cells to pass by in single file only. In the most distal portions some of the loops become constricted off, at first show stagnant blood and later are obliterated entirely. In our experience the proximal loops have never completely disappeared, though they have been grossly invisible. When such an eye is re-injected, or otherwise irritated—by the introduction of O. T. into the sac, for example—the blood flow through these capillaries is increased and they can again be seen with the unaided eye as a fringe of newly formed vessels.

Although vessel formation is particularly striking in response to the tubercle bacillus, it can also occur after mechanical injury or injection with other organisms. Börri (10) in 1895, showed that after mechanical erosion of the cornea, or injection of mercury bichloride or hydrochloric acid, newly formed vessels developed from the limbus and extended into the dulled area. In our series where mercury sulphide had been injected, very short loops of newly formed vessels developed in the two cases where a heavy emulsion was used and failed to develop in the two where smaller amounts of the mercury had entered the cornea. With the *staphylococcus aureus* active vascularization took place in all cases, extending from above well into

the area of inoculation. A fairly active circulation was maintained and persisted throughout the period of observation (10 weeks). Here it was interesting to observe that the veins were much more numerous than the arteries and at least three times as wide in diameter.

Changes in the Cornea.—The structure of the normal cornea as seen with the slit lamp and corneal microscope has been described by Koeppe (11) in his book entitled *Die Mikroskopie des Lebenden Auges*, and is pictured by Vogt (12) in his book, *Atlas of Slit-Lamp Microscopy*. When an emulsion of tubercle bacilli—or other foreign matter—is injected into the corneal stroma, a diffuse grayish-white opacity is formed, which fades within five minutes so as to be almost imperceptible. Microscopically it consists of an irregular gray granular area, lying at varying levels of the cornea and showing an epithelial defect at the point where the needle entered. At times instead of the grayish-white opacity described above, a heavy white lesion composed of short parallel lines results. Such an opacity consists of roughly square areas, each made up of 4–6 parallel lines. On a level just above or below such a square is another whose lines run at another angle which may be a right angle or as small as 15°. By superimposing these squares at different levels, the opacity is produced. This opacity does not fade within five minutes but appears practically unchanged in fifteen minutes. Within 18 hours it differs from the usual lesion only in its tendency to long finger-like projections extending from the main opacity into the surrounding tissue. The further course of the two lesions is otherwise identical. The large white opacity cannot be produced at will, but occurs only as a rare accident, in our series twice in 40 cases.

For the first 3 to 6 days the opacity at the site of inoculation remains unchanged. It has an irregular but well-defined outline and a distinctly granular appearance, dependent on the accidental grouping of the masses of organisms injected. The epithelial defect due to the needle puncture gradually disappears within twenty-four to forty-eight hours. On anywhere from the 4th to the 7th day (with occasional cases as early as the 3d, and one as late as the 12th day) the opacity begins to lose its definite edges and its granular appearance. The cornea immediately beneath and surrounding it becomes white and

opaque and the edges of the lesion blend with the surrounding tissue, while the opacity itself changes from a grayish granular to a fluffy yellowish white homogeneous mass of cotton-like appearance in which, within 2 to 3 days, a granular structure can no longer be made out. At this time there is usually a halo of less dense opacity about the central heavy yellowish-white area. Still later this mass breaks up into numerous small white lesions, lying peripherally and grouped as satellites about a larger central yellowish-white area. These are the miliary tubercles so characteristic of the advanced stages of corneal tuberculosis. At the time that the breaking up into small masses occurs, the vessels extend well into the opaque area and ulceration usually begins.

The course of events above described is that which takes place when the lesion goes on to ultimate destruction. In case healing occurs, the fluffy white mass soon regains its granular look and is definitely walled off from the cornea surrounding it. These changes were best studied in the rabbits injected with mercury sulphide, as the breaking up of the red masses can be more easily followed than that of the pale bacillary emulsions. In these rabbits no changes occurred in the dense red masses infiltrating the cornea until after the acute exudation of eucocytes had ceased and the surrounding cornea had been heavily infiltrated with cells. There then occurred a gradual breaking up of the dense red areas into smaller, more granular masses, especially at the periphery. For some distance about the injection site the cornea showed small foci of red granules. Where the mercury sulphide had extended along dense lines, these lines became broken and eventually assumed a dotted appearance. The dense central masses were, however, largely unaffected. Apparently none, or at best very little, of the mercury sulphide was removed, for the red areas appeared to be quantitatively the same when healing was complete as when first injected. The arrangement, however, was of a more broken and granular kind. Ten weeks after inoculation they persisted unchanged, though for the past 8 weeks the eye had otherwise been entirely normal.

A healed tuberculous or staphylococcus infection leaves a grayish granular opacity with well-defined boundaries, in a normal cornea, which persists indefinitely.

Occurring simultaneously with the changes in the opacity at the inoculation site, or perhaps shortly thereafter, the cornea loses its normal glistening appearance and becomes infiltrated with white cells. The part of the cornea first involved is that immediately surrounding the point of inoculation. Soon afterwards, or occasionally at the same time, the cornea becomes cloudy at the limbus above and shows a great increase in white dots—probably an infiltration with wandering cells. This dullness rapidly spreads so that within a few days the entire cornea is opaque.

DISCUSSION.

In a general way our results may be said to agree with those of other investigators, with the exception, however, that in every case we have been able to observe changes earlier than any hitherto reported. This is due partly to the slit lamp method of examination by means of which slight changes can early be seen, and partly to the fact that we used cultures of great virulence for rabbits. Nevertheless, we cannot get away from the fact that after the introduction of tubercle bacilli there is a latent period during which no reaction occurs, which is more definite and prolonged than when a simple foreign body or a pyogenic organism is used.

The stages during which we followed the tuberculous lesion were largely exudative. The question of the origin of cells into the aqueous has always been a matter of speculation. It is our belief that the extreme dilatation of the small iris vessels, observed prior to the cellular exudation, might permit the passage of wandering cells from these vessels into the anterior chamber. We have at several times seen a severely congested iris on the evening of one day, and the following morning have found the aqueous full of cells. We do not wish to infer, however, that the iris is the only possible source of cells in the anterior chamber. The cells in the primary exudation are probably largely leucocytes; in appearance they resemble the cells found after foreign body injection. Puncture of the aqueous, carried out in one case, showed the presence of polymorphonuclear leucocytes only. This cellular reaction, there-

fore, is not specific, but is simply due to foreign body stimulation.

After a time, however, this first active exudation of cells into the aqueous subsides and there are seen smaller numbers of cells chiefly on the lens surface and on Descemet's membrane which we believe to be lymphocytes.

The settling out of these precipitates on the lens has been often observed by ophthalmologists and has been attributed by them to the mechanical factor that man sleeps on his back. It was, likewise held, especially by Straub (13), that the clumps of cells on the lens and on Descemet's membrane were the result of a chance piling up of single cells. We have been able to show that the cells form loose clumps in the aqueous and float on to the lens or Descemet's membrane as a raft, as has been Fuchs' (14) assertion. That there is some specific substance in the lens which attracts cells toward it seems probable. Cells are never found on the iris when the aqueous is clear, but are often seen on the lens. In the rabbit, of course, there could be no purely mechanical sedimentation on to the lens, though sedimentation does undoubtedly occur on Descemet's membrane in the chamber angle. At times, however, precipitates are seen on Descemet's membrane in the small area about the primary lesion, and here too there may be some unknown substance which causes a migration to this area.

Lewis and Montgomery called attention to the significance of the exudation in tuberculosis and have remarked that if it were possible to prevent the exudation entirely, blood vessels would presumably never develop. We can confirm this in another way. The disappearance of the cellular exudation was in every instance the precursor of healing. On the other hand, while the exudate persists there is progressive destruction of the eye.

In connection with the new formation of blood vessels, it should be noted that increased circulation through existing vessels antedated the development of new capillaries and that a slowing of the blood stream was a sign that healing had begun. These phenomena must occur in response to some definite stimulus given out by the infecting organism or its product.

The fluffy white masses which we have observed in the cornea about the injected area resemble precisely the appear-

ance of the fibrinous exudate which is often seen in an otherwise transparent retina. We may, therefore, assume that the cotton-like appearance of the corneal lesion is likewise due to exudation about the point of injection. The clouding of the cornea itself takes place first about the site of inoculation and at the limbus above. The time of its appearance and the fact that it occurs primarily and most markedly in the areas where there was the most abundant blood supply, seem to indicate that the first corneal clouding results from infiltration of the stroma by wandering cells and that proliferation of the fixed tissue cells occurs only at a later date.

Our observations thus lead us to the conclusion that exudative inflammation is the first and most important tissue reaction in response to tuberculous infection.

SUMMARY.

1. The slit lamp and corneal microscope offer a valuable method for the experimental study of fundamental pathological processes as they take place in the living tissue of the eye.

2. In the study of experimental corneal tuberculosis produced by inoculation of emulsions of virulent bovine strains, the first change is seen most commonly three to four days after injection, and consists of congestion of the vessels of the iris and of the bulb, with an increase in the volume and speed of the blood flow.

3. After one injection of virulent tubercle bacilli, cellular exudations of white and pigmented cells occur within 3 to 8, usually 4, days. The cells are seen in the aqueous, on the lens surface, and on Descemet's membrane, at first single, later grouped, then clumped. Eventually the cells drop into the chamber angle and form grossly visible hypopion. When an avirulent culture has been used, cells are seen in the aqueous and on the lens three to four days after inoculation. They occur singly or in small clumps, disappear entirely within 24 to 48 hours, and are never found on Descemet's membrane.

Twenty-four hours after inoculation with *staphylococcus aureus*, the anterior chamber is densely packed with white cells, single and clumped, which settle out on the lens in the chamber angle, and on Descemet's membrane. Within one to

three days all cells disappear except for a small sprinkling on the lens which persists for 3 weeks.

After injection of large amounts of mercury sulphide, the anterior chamber and lens are packed with cells 2 to 3 days after inoculation. These persist for one week and occur at first singly, then in clumps, and finally singly again. When smaller amounts are used, the first cellular reaction takes place on the 5th to 6th day, and all cells disappear in 3 days.

4. Corneal vascularization occurs after any sufficiently severe irritation of the cornea. It is most characteristic in tuberculosis. New formed vessels arise on the 5th to the 7th day after inoculation. They begin as straight shoots which later form loops through which a very active circulation is maintained. Vessels are best studied after the introduction of avirulent tubercle bacilli. When healing occurs the new formed vessels become grossly invisible but persist as very fine capillaries microscopically. After irritation they become filled with blood and can again be seen grossly.

5. Inoculation of an emulsion of tubercle bacilli into the cornea causes the formation of a gray, granular opacity which fades within five minutes, or of a dense streaked white opacity which persists unchanged after 15 minutes. After 4 to 7 days this opacity becomes yellowish-white and fluffy, and eventually is broken up into miliary tubercles with ulceration. If healing occurs the gray granular appearance again replaces the white fluffy opacity, the surrounding cornea and the cornea at the limbus above is infiltrated with white cells and becomes dull and opaque.

BIBLIOGRAPHY.

1. COHNHEIM and SALOMONSON. "Über Künstliche Tuberkulose," in Cohnheim, *Gesammelte Abhandlungen*, Berlin, 1885, 591.
2. HAENSELL, P. "Beiträge zur Lehre von der Tuberkulose der Iris, Cornea u. Conjunctiva." *v. Graefe's Arch. f. Oph.*, B. xxv., 4, 1879.
3. PANAS et VASSAUX. "Etude expérimentale sur la tuberculose de la cornée." *Archiv. d'ophthal.*, v., p. 194, 1885.
4. KOSTENITSCH et WOLKOW. "Recherches sur le développement du tubercle expérimental." *Archives de médecine expérimentale*, T. iv. 1892.
5. HEYDEMANN, LUDWIG. "Beitrag sur Histogenese des Hornhaut-tuberkels. *Inaug. Diss. Greifswald*, 1894.

6. SCHIECK, Fr. "Über die ersten Stadien der experimentellen Tuberkulose der Kaninchencornea." *Ziegler's Beiträge z. path. Anat. u. allg. Pathol.*, xx., Heft 2, 1896.
7. BACH. "Die Tuberkulose der Hornhaut." *Arch. f. Augenheilk.*, xxxii., 149, 1896.
8. KRUSIUS. "Zur experimentellen Tuberkulose des Auges." *Deutsch. Med. Wochnschr.* S. 1545, 1911.
KRUSIUS. "Demonstration experimenteller Tuberkulose des Auges. *Ber. u. d. 37 Vers. der ophthal. Gesellsch.*, s. 345, 1911.
9. LEWIS, PAUL A., and MONTGOMERY, CHAS. M. "Experimental Tuberculosis of the Cornea." *Jour. Exp. Med.*, vol. xx., No. 3, 1914.
10. BÖRRI, EMIL. "Experimentelle Keratitis parenchymatosa hervorgerufen durch Einwirkungen auf das Endothel der Hornhaut." *Inaug. Diss.*, Basel, 1895.
11. KOEPPE, L. *Mikroskopie des Lebenden Auges*. Julius Springer, Berlin, 1920.
12. VOGT, A. *Atlas of Slit-Lamp Microscopy*. Julius Springer, Berlin, 1921.
13. STRAUB. *Arch. f. Ophthalmol.* Vol. lxxxvi.
14. FUCHS, ERNST. *Arch. f. Ophthalmol.* Vol. lxxxiv.

OCULAR SPOROTRICHOSIS.¹

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(With four illustrations on Text-Plate XXI.)

THE interest of this case arises first from the unusual location of the process in the lacrymal sac, and second from its being the fifth case in the United States in which a diagnosis of ocular sporotrichosis was confirmed by culture.

CASE.—Adolph, aged 8, a farmer's son of Belvidere, So. Dakota, was first seen by Dr. H. Gifford, March 6, 1922. Three months before, a swelling developed over the left lacrymal sac. It was incised by his family doctor, but the opening continued to discharge. When first seen, he showed a fistula just below the lacrymal sac from which a good deal of pus could be squeezed out. The edges of the fistula were thickened, red and everted. (See Fig. 1.) Exploration under general anæsthetic showed that the opening was $\frac{3}{8}$ inch in diameter and extended back $1\frac{1}{2}$ inches into the left anterior ethmoid cells, which were full of pus. The lacrymal sac was continuous with this opening and over the whole inner wall the bone was left bare. The ethmoid cells were exenterated by Dr. John B. Potts, intranasally, after removal of the left middle turbinate and the passage was enlarged so that a tube could be placed through it into the nose, making a modified West operation. The discharge was much less on his return home four days later. On account of the laboratory findings, he was put on potassium iodide at home. Two months later his doctor wrote that there was less swelling but still some discharge. He had

¹ Read before the Sioux Valley Eye and Ear Academy, July, 1922.

been obliged to stop the iodide on account of gastro-intestinal disturbances.

He returned three months later. The opening was still present in the skin but only a few drops of pus could be squeezed out of it. The fistula was cauterized with trichloracetic acid and tincture of iodine was applied to the deepest parts several times. In spite of this and general treatment with potassium iodide, the sac has continued to fill up with pus and a fairly deep opening in the bone is still present, though the opening into the nose has closed up. After the connection between the conjunctival sac and fistula had been destroyed by cauterization so that the tears could no longer get into the bottom of the fistulous opening, it began to heal better and at present seems to be healing from the bottom, though slowly.

Bacteriologic Findings.—Smears of the pus at the first examination showed no organisms. Culture on plain agar left at room temperature showed after five days six discrete white colonies of slightly leathery consistence, with fine lines radiating from them (Fig. 2). Smears of these colonies showed the separate threads with lateral and terminal spores characteristic of *Sporothrix Schenckii* (Fig. 3). A white rat inoculated with the pure culture died in seven days and the organism was recovered from the peritoneal cavity. A rabbit inoculated in the anterior chamber developed nodules in the iris and cornea with a severe reaction, which subsided after three or four weeks. Dr. Hektoen of the John McCormick Memorial Institute kindly examined my material and pronounced the organism *Sporothrix Schenckii*. At the patient's second visit, only ordinary pyogenic organisms could be found in the pus by culture, evidently secondary invaders.

Since H. Gifford's paper, in 1910, besides the present case in which the culture was positive, we have seen at least two other cases which were probably of sporotrichotic origin, although cultures were negative. The first was a girl of thirteen years with an ulcer including the outer third of the right upper eyelid with some enlargement of the glands on that side. Culture of the material curetted from the region was negative, but the ulcer healed up rapidly under potassium iodide. The second case is very similar to H. Gifford's first case and concerns a girl of 21 with a nodule of the conjunctiva at the outer limbus, which had existed for about six months and had been removed once by another doctor but had recurred. When seen, the appearance was that seen in Fig. 4. Cultures at room tem-

perature and in the incubator were negative. The lesion cleared up under potassium iodide.

Literature.—After Schenk's first report in 1898, and its confirmation by Hektoen and Perkins in 1900, a number of cases of sporotrichosis were reported, chiefly in this country and France. Among these were a number involving the eyes and adnexa, but these were nearly all from France. The first American case of ocular sporotrichosis was that of H. Gifford (1) in 1910. The lesion involved the ocular conjunctiva, a location which had not previously been reported and sporothrix was grown in cultures. He describes five other cases which were almost certainly of like origin, four of these involving the lids, the other the conjunctiva and lacrymal sac. In two of the lid cases also the lesion was situated over the tear sac, and may have originated from it. Wilder and McCullough (2) in 1913 reported conjunctival sporotrichosis occurring in one of the authors who received part of a pure culture of sporothrix, with which he was working, in his conjunctival sac. It is interesting as showing that infection can occur on an apparently intact conjunctiva. The local and general reaction was severe, but responded to potassium iodide. Careful observations were made, including agglutination tests with the patient's serum against five strains of sporothrix, all of which were equally positive. Increase of opsonic index for all strains was equally marked. This is of bacteriologic value, as added evidence of the identity of *Sporothrix Schenckii* and *Sporothrix Beurmanni*, since one of the strains used was the latter. Dwyer and Larkin (3) in discussing Wilder's paper, described a case with generalized sporotrichotic abscesses, several of which were on the lids. His serum was markedly positive. This would be the third American report, though I believe no detailed description of the case has appeared. Bedell (4) in 1914, reported the fourth proven American case, a chronic conjunctival involvement with a rather large granulation mass on the inner side of one lid. The canaliculi and lacrymal sac contained a number of brown masses resembling streptothrix concretions but yielding sporothrix on culture.

Since most of the cases before 1913 are well summarized by Wilder and McCullough, and Bedell's paper gives a complete bibliography up to 1914, it will be necessary only briefly to

mention a few cases not described by the former writers and those reported since 1914. Toulant (5) summarizes the subject very completely, transcribing practically in full all reports previous to 1913. Of the 23 cases he collected, 22 were reported in France, the other one being H. Gifford's. Of these cases the lesions involved the skin of the lids in six, the conjunctiva in six, the lacrimal sac in one, the brow in one, the interior of the globe in six and the orbit and lids together in three. Four cases were fatal, some from the cachexia of a general infection, one from an intercurrent disease.

In thirteen of the twenty-three cases, the ocular infection was primary, and this was especially true of the palpebral and conjunctival lesions. All six intraocular involvements were secondary to generalized sporotrichosis, the infection being carried by the blood stream, as has been shown in animals by Bourdier (6) and Toulant. To his summary may be added nine later cases, all but 3 of which were confirmed by bacteriologic evidence, making a total of 32 cases. Of the nine later cases, 6 involved chiefly conjunctiva or cornea, one the lids, one the orbit, and one the lacrimal sac. Of the cases not described in Wilder's report, that of Legry, Sourdèl and Velter (7) is worthy of note, a violent iridocyclitis with sporotrichotic gummatæ of the iris, and later perforation of the sclera, occurring as an incident in generalized sporotrichosis. Chaillous (8) saw a case of panophthalmitis ending in phthisis bulbi, but here the infection was probably from an ulcer of the lid border causing secondary ulcers on the limbus from which the infection evidently involved the globe. Dor's case (9) is interesting, since the child developed his infection first on the lesion of a smallpox vaccination. From here he evidently inoculated his cornea by a finger and an ulcer ensued which ended in a staphyloma. The diagnosis was not made until a characteristic gumma on the sternum developed, and the potassium iodide given after this resulted in recovery from what otherwise would have been, apparently, a fatal infection.

Since Bedell's paper, only 4 reports of ocular sporotrichosis have appeared, one each from France, Spain, Italy and Mexico. Positive cultures were obtained in two of these cases. Thibierge and Chaillous (10) in 1914 reported a case of intraocular infection, the only case, so far as I know, in which the retina

was involved. The patient had had numerous subcutaneous nodules, including one on the eyelid. Later an iritis with synechiæ developed, apparently by an independent metastatic process, vitreous opacities formed and a large raised yellow spot appeared in the retina. Vision was reduced to counting fingers.

Leoz (11) in 1917 describes a case seen by Balbuena and himself, which, when Balbuena reported it at a society meeting in 1915, was the first Spanish case. The patient presented corneal scars and 4-5 crateriform ulcers of both corneæ. The submaxillary glands were enlarged, but there was only slight congestion about the corneæ. The ulcers healed under potassium iodide in doses up to six grams a day. When this was stopped on account of iodism, a conjunctival gumma developed and then similar nodules over the insertions of all the ocular muscles. Fluid from one of these gave sporothrix on culture, and under potassium iodide by mouth and injection of 5% potassium iodide solution into the nodules, all gradually disappeared. He saw another case, with numerous nodules on the cornea and sclera which yielded to potassium iodide and were considered sporotrichotic in origin, though there was no material for cultures. In another case, a child of eleven, with numerous gummata all over the body, both eyes were involved. The right lower lid was destroyed, the eye was atrophic, and a purulent infection was present in the orbit. The left cornea was entirely destroyed and two conjunctival gummata were present. The child was totally blind and practically moribund. This was before the author knew of sporotrichosis and under mercury and salvarsan, the process went on to death in two months. No cultures were made, but after seeing cases of sporotrichosis, it was considered to have been certainly of that nature. Oreste (12) in 1919 reported an apparently typical case of conjunctival sporotrichosis in a medical officer. It yielded to potassium iodide but was not cultured.

Gonzalez (13) in 1921 reported a remarkable case of orbital involvement. The patient, a woman of 21, showed gradually increasing exophthalmos, paralysis of most of the ocular muscles, and a severe corneal ulcer from exposure. Tuberculin tests were negative, and mercury had no effect. On incision into the orbital mass, a little pus escaped, but symptoms remained the same. A nodule behind the ear was present. After

being lost sight of for four years, the patient returned in a much worse general condition, with a blind eye protruding beyond the lids, complete ankylosis of the jaw, and ulcers of the sternum and parietal bone. Smears of pus from the latter lesion showed spores and a few threads, and under potassium iodide immediate improvement began. All the lesions healed, and the exophthalmos disappeared, though the globe remained immovable, even to digital pressure, being evidently held in a mass of adhesions. Though no cultures were made, the author made the diagnosis of sporotrichosis clinically and from the smears.

In relation to the present case, a brief account of one of Morax's cases (14) would seem in place as it is apparently the only other proven case with a definite dacryocystitis. (Bedell's lacrimal concretions produced an entirely different picture.) Morax's patient was a man of forty who had been suffering from lacrimation of the left eye for about two years. His glands were swollen and he had two nodules on the cheek. When first seen, a severe dacryocystitis had existed for five weeks and a pre-lacrimal abscess had formed. After opening and curetting the caseous mass, the duct could be probed easily and function was restored. Culture was positive. In another of his cases (15) with a nodule over the sac, an origin from the sac seemed likely, but the sac and ducts had been left intact.

With regard to the bacteriology of the disease, it was formerly believed that two distinct organisms, *Sporothrix Schenckii* and *Sporothrix Beurmanni*, were responsible for most of the reported cases, the first causing all of the American cases, and the latter almost all of the French ones. Davis (16), however, has apparently proven that the two strains are identical and hence should both be called *Sporothrix Schenckii*, after the prior observer. He found pigment formation to vary greatly in both strains, and that both could form chlamydospores. As concerns agglutination, complement fixation and skin reactions, experiments with both strains gave identical results, as Wilder and McCullough had shown in part. He believes there are two varieties, Sp. Dori and Sp. Councilmanni, which are distinct and which have caused a very few human infections, but that practically all cases are due to one organism, Sp. Schenckii.

In America, as is well known, sporotrichosis is peculiarly a disease of the Mississippi basin. Of 58 American cases collected by Hamburger (17) up to 1912, fifty were from the Mississippi basin, 22 were from North Dakota, where it occurs also in horses, and 13 were from Kansas. This is partly due, no doubt, to the fact that where one case has been reported, clinicians are on the lookout for others. Thus Sutton (18) in eight months saw five cases. Morax reported four and H. Gifford six cases of ocular sporotrichosis. The only other cases of any form of sporotrichosis reported from Nebraska are by Wohl (19), MacLean (20) (the latter's patient having come from South Dakota) and Watson (22). Watson's five cases, all involving the upper extremity, all came from an area in Nebraska within twenty miles of each other.

This means that many cases are probably being missed, as wherever special attention has been paid to it, cases have been observed. They have now been seen all over Europe, in South America, Mexico, probably in India and even in Madagascar. (Davis.) It is remarkable that there are not more cases, as its cause is fairly common in nature, pathogenic organisms having been obtained from several common plants. (Toulant 5.)

This summary of cases and the reports of Wilder, Toulant, and others give some suggestion of the protean nature of the disease. It may affect all parts of the eye, and under quite different appearances. Since the lesions are persistent and recurrent, causing serious destruction of tissue, and even death in a few cases, if left untreated, and since we have in potassium iodide such an effective agent against them, it is especially important that the various forms of sporotrichosis be kept in mind. The most common forms are ulcers of the lids and conjunctival sporotrichosis. But besides the typical ulcers developing from papules and involving chiefly the epithelium, the larger subcutaneous gummata must be remembered, which may break down to form deeper ulcers, or extend into the orbit, sometimes involving its bony walls. The lesion may develop in the bony walls themselves, as it does in the long bones and skull. In all these cases, syphilis and tuberculosis must be excluded and often the diagnosis can only be made by positive culture. This is especially true in differentiating the con-

junctival form from Parinaud's conjunctivitis, which it may exactly resemble. One culture should be left at room temperature for five to six days but by Gougerot's method of examining the walls of the tube over which the pus was streaked, a diagnosis may often be made earlier. The intraocular forms are usually diagnosed by looking for the presence of lesions elsewhere which will give clinical or cultural evidence.

Treatment, as is well known, is by free use of the iodides internally, from sixty to 180 grains daily, combined, according to some authors, with collyria of potassium iodide and injections into the lesions. Davis (21) has shown that potassium iodide has no bactericidal effect on the organisms, but in some way stimulates the tissues to wall them off and destroy them. This occurs slowly, and hence it is important to continue iodide treatment for a considerable time after apparent healing, otherwise the lesions will recur.

BIBLIOGRAPHY.

1. GIFFORD, H. *Oph. Record*, 1910, xix., p. 580.
2. WILDER and McCULLOUGH. *J. A. M. A.*, 1914, lxii., p. 1156.
3. DWYER and LARKIN. "N. Y. Academy Oph. Soc., Dec. 15, 1915." Abst. in *Arch. of Oph.*, 1914, xlv., p. 162.
4. BEDELL. *Proc. Am. Oph. Soc.*, 1914, xiii., 720.
5. TOULANT. "La Sporotrichose Oculaire." *Thèse de Paris*, 1913. (Surgeon General's Library.)
6. BOURDIER. *Arch. d'Oph.*, 1912, xxix., p. 601.
7. LEGRY, SOURDEL and VELTER. *Ann. d'Oc.*, 1911, cxlvii., p. 142.
8. CHAILLOUS. *Ann. d'Oc.*, 1912, cxlviii., p. 321.
9. DOR. *La Clin. Oph.*, 1911, xvii., p. 121.
10. THIBIERGE and CHAILLOUS. *La Clinique Oph.*, 1914, xx., p. 126.
11. LEOZ. *Arch. de Oft. Hispano-Americano*, 1917, xvii., p. 193.
12. ORESTE. *Gaz. Med. Napoletana*, 1919, ii., p. 326.
13. GONZALEZ. *Ann. de la Soc. Mexicana de Oft. y Oto-Rino-Lar.*, Febr., 1921.
14. MORAX. *Ann. d'Oc.*, 1911, cxlv., p. 49.
15. MORAX. *Ann. d'Oc.*, 1913, cxlix., p. 183.
16. DAVIS, D. J. *J. Inf. Dis.*, 1914, xv., p. 483; Univ. of Wisconsin Studies (Russell Anniversary Vol.), p. 105.
17. HAMBURGER. *J. A. M. A.*, 1912, lix., p. 1590.
18. SUTTON. *J. A. M. A.*, 1914, lxiii., p. 1155.
19. WOHL. *Nebr. State Med. Journal*, 1920, v., p. 355.
20. MACLEAN. *J. A. M. A.*, 1917, lxix., p. 1774.
21. DAVIS, D. J. *J. Inf. Dis.*, 1919, xxv., p. 124.
22. WATSON. *Nebr. State Med. Jour.*, 1922, vii., p. 282.

A NEW METHOD OF REMOVING THE LENS IN ITS CAPSULE.

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(With four figures in the text.)

THE removal of the lens in its capsule is a very old procedure; all ophthalmic surgeons admit that if it could be performed without the loss of vitreous it would be an ideal operation, as it reduces the after complications enormously. Macnamara performed it in preference to any other operation, and as I was his house surgeon for two years I can testify to the excellence of most of his results. He performed the operation in a very simple manner. He operated by opening the cornea with a very broad straight keratome, which was perfectly square, having one corner directed in front, which served as the entrance point. This he inserted obliquely through the cornea at the limbus, and then lowering the handle he pushed the keratome above the iris right to the opposite side of the eye as far as the blade would go without actually touching the ciliary body. He then withdrew the knife and holding the eye with the fixation forceps to steady it, inserted a flat spoon which had a thickened rim in front, right into the wound. Then rotating the handle so as to bring the spoon under the iris nearest to him, he transfixed the ligament, and reversing the direction of the handle, he slid the spoon along the back surface of the lens until he caught its opposite edge, and drew the latter out of the wound in its capsule. This operation caused the shaft of the spoon to press the iris towards the periphery, which resulted in the pupil becoming pearshaped, a condition which usually remained permanently after the opera-

tion. This, however, was no practical objection, as it did not materially affect vision. The chief objection lay in the fact that the act of pushing the spoon behind the lens and dragging the lens out caused a small amount of vitreous to escape in a good many cases, although rarely an amount sufficient to become a danger to the sight. Notwithstanding this, it was an excellent operation, although it was capable of considerable improvement. I, therefore, at a later date made a number of experiments on animals, and as a result came to the conclusion that if I could extract the lens from the front instead of from behind I should greatly diminish the chance of losing vitreous. My experiments confirmed my theory, with the result that now I never resort to any other method of extraction in favorable cases. Of course there are cases in which the operation is not suitable, but these the surgeon will readily discover for himself, and they need no description. The operation is much simpler than Smith's, for the reason that the lens is never rotated so as to cause a "tumbler" as Smith calls it. Moreover the operation requires a minimum of skilled assistance, since the operator merely requires his assistant to hold the upper lid away from the eye during extraction, and at the same time with his other hand to steady the eye with a fixation forceps. I may however add that in many cases the ligament is so fragile that it is preferable to squeeze the lens in its capsule right out through the wound by simple pressure with a squint hook on the cornea, at the gap between the edge of the lens and the ciliary ridge, in other words, just above the circumlental space.

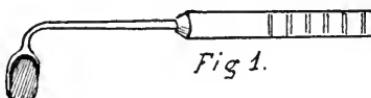
Should, however, the lens refuse to budge *on slight pressure* I at once revert to the spoon method. I have performed either this operation, or the simpler one just described for very many years, and I never had any wish to return to the more classical methods.

Preliminary procedures.—Before operating I first examine the nasal cavities and sinuses with a mirror, and if they prove satisfactory I thoroughly flush out the eyelids with warm neutral saline. I then place a sterilized pad of lint and a bandage on the eye, and leave it for twenty-four hours undisturbed. If at the end of that time the pad is quite clean, without a trace of mucus or pus, I know it is safe to begin the operation. This is preferable to any bacteriological examination of the lids,

as there are always some pathogenic germs present, and they are apt to herald danger which does not exist. The day before operating I also drop some atropin into the eye and if the pupil does not dilate I suspect adhesions, and take measures accordingly. It is always a good plan to give the patient a day's rest in bed before operating, as it tends to calm him, and at the same time one can get his bowels attended to.

I will first describe the simple method.

I make the usual incision $1\frac{1}{2}mm$ below the horizontal diameter of the cornea, and $1mm$ outside the limbus, carrying the narrow Graefe knife (which should never be less than $32mm$ long in the blade) just inside the cornea all the way through. This makes the largest section possible, *i.e.* one very nearly equal to half the circumference of the cornea. I then perform an iridectomy in the usual way. If there is much bleeding on cutting the iris, I prefer to put off any further operation for a week or ten days, until all the blood has disappeared. I have always regretted not doing this, and never regretted waiting. If I suspect adhesions, I pass a small silver spatula between the lens and the iris, so as to free it all the way round. I then remove the speculum, and get my assistant to hold up the upper lid with a squint hook after Smith's method. With his other hand the assistant grasps the conjunctiva at the lower side of the eye, without putting the slightest pressure or traction on the globe. I then take a shallow flat silver spoon shaped like a shovel (Fig 1) which I insert into the wound, and pressing it slightly downwards and forwards (*i.e.* towards myself) push it through the ligament into the vitreous a very little way, so that it is just past the free edge of the lens in its capsule. The moment I gently tilt the edge of the lens up, a little vitreous will usually show itself if the eye is healthy. It is a good sign, as it shows that everything is going well with the eye. If it



The shovel spoon. Actual size.

tends to get out of control and protrude too much, I get my assistant to gently pull the conjunctiva upwards and

slightly away from the eye. This at once causes the vitreous to recede. Then taking a second squint hook in my right hand, I press the cornea with it, the concavity of the hook facing me, and press it firmly down into the circumlental space immediately in front of the ciliary ridge. As I increase the pressure I can feel the edge of the lens beneath the now doubled up cornea. This pressure causes the wound to gape enormously. As I continue the pressure at the same time altering the direction of the hook towards the gaping wound, the lens intact in its capsule comes rapidly forwards on the shovel, completely filling the mouth of the wound, and thus entirely preventing the vitreous from escaping. Should, however, the least sign of its doing so appear, the slightest traction of my assistant's fixation forceps away from the globe causes it to recede immediately. The lens in its capsule slides along the bowl of the trowel, and as it emerges the wound closes over it, until the two edges meet together. Nothing now remains to be done except to adjust the edges of the iris so that they do not catch in the wound, and then carefully bandage up the eyes. As soon as the bandage is adjusted, I generally put a wire cup-shaped screen over the eye, so that the edges rest on the rim of the socket. This I remove at the end of the fifth day, *i.e.* as soon as the wound is sealed up.

The alternative operation.—In some cases it will be found that the ligament will not yield easily to slight pressure, so as to allow of the lens being pushed out in its capsule by the squint hook. In these cases I employ a specially designed spoon which I got Luer of Paris to make for me (see Fig. 2).



The extraction spoon. Actual size.

It consists of a nearly flat silver spoon having a slight lip at its end. This lip is quite sharp, but folded forward so as to be parallel with the floor of the spoon. It will thus be seen that it cannot injure the iris or capsule when it is gently pushed between the two. The shaft is bent at an angle so as to enable one to slide it more easily along the capsule beneath the iris

as far as the edge of the lens, when the lip of the spoon can be felt to slip over its edge, and the slightest traction of the handle will cause the point to dig into it. This effectually prevents the lens slipping away from the spoon, when the end of the lens is depressed so as to bring the other end into the wound along the floor of the shovel.

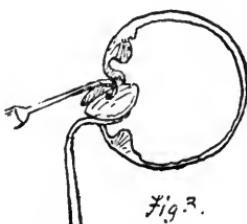


Fig. 3.

Diagram of squeezing out method. (Fig. 3)

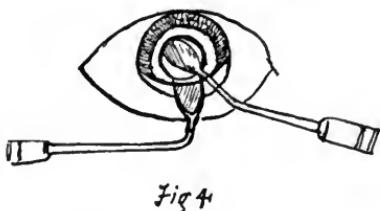


Fig. 4.

Diagram of forcible extraction method. (Fig. 4)

A little traction and coaxing will cause the lens in its bag to slide beautifully along the sloping shovel out of the wound. During all these years I have rarely lost any serious amount of vitreous, and the last ten years I have never lost enough to have the slightest effect on vision. My experience goes to show that so long as the vitreous completely covers the whole of the retina up to and including the ora serrata, no harm to vision will result, but once the loss causes the ora to be uncovered the result will be unfavorable in direct proportion to the amount of vitreous lost, and this will become more evident as time goes on.

In my cases of recent years I have never lost more than would equal a pea in amount.

In my operations there are only six things which I have to fear. They are, internal hemorrhage with consequent glaucoma; retinal detachment; iritis; suppuration; rupture of the capsule with consequent breaking up of the lens and with the danger of some pieces being left behind; and lastly, failure of the wound to heal.

The three first are unavoidable. Suppuration in my cases has always been due, either to unsuspected nasal discharge, or—and that is far more common—to the patient working his septic fingers under the bandages to relieve the itching which

invariably accompanies a wound. Rupture of the capsule may nearly always be avoided by pushing the shovel well under the edge of the lens before pressure is applied to dislocate it from its attachments. By this means, the moment pressure is applied to the opposite side of the lens, there is nothing to oppose its coming forwards, and consequently there is no pressure put on the capsule to rupture it. Lastly non-closure of the wound usually happens in the case of feeble or diabetic patients, but one can generally obtain healing by cauterizing the edges of the wound, together with liberal doses of opium administered by the mouth.

In conclusion, if the reader will try these two methods I feel convinced he will be pleased with the splendid results he is sure to get. Both the shovel and the special spoon can be obtained from Luer, 104 Boulevard, St. Germain, Paris. The shovel is shown in Fig. 337 of Luer's catalogue for 1909, the only difference being that I bent the shaft to a right angle to keep the handle out of the way when operating. The traction spoon was made specially from my design by Luer, but the drawing (Fig. 2) is sufficiently accurate to enable him to make a copy.

BLEPHAROCHALASIS.

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FRIEDENWALD.

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(With three illustrations on Text-Plate XXII.)

BLEPHAROCHALASIS, though a rare condition, has, nevertheless, been subject to fairly frequent pathological studies. This is readily explained by the fact that the treatment of these cases is so commonly surgical. We wish to report this case because it shows certain lesions not previously described, and particularly because these lesions offer a possible clue as to the pathogenesis of the condition.¹

CLINICAL HISTORY.²

Miss Mary G., aged 20, was first seen on September 25, 1921. She complained of a peculiar enlargement of both upper lids, which had come on suddenly about 3 years before. She stated that she had wept a great deal one day and that her lids had become greatly swollen in the evening. On the following day she was surprised to find that the swelling had not disappeared. In the course of three years this swelling had gradually increased. No other changes were noted.

The skin of the upper lids was very finely wrinkled, loose and redundant and gave the appearance seen in the aged whose fat tissue has disappeared, but in contrast to this,

¹ For a review of the literature see Loeser (9).

² We are indebted to Dr. Harry Friedenwald of Baltimore for the history and for the specimens examined.

her lids were slightly puffy (Fig. 1). The skin was soft and even to the feel, and contained no nodules. The eyes were otherwise healthy, the eyegrounds normal.

$$\begin{aligned}V. \text{ od.} - 1. \text{ S.} - 1.25 \text{ c. ax } 105 &= \frac{1}{8} \\V. \text{ os.} - .75 - 50 \text{ ax } 90 &= \frac{1}{8}\end{aligned}$$

Clinical diagnosis, blepharochalasis.

On October 14, 1921, under local anaesthesia an elliptical strip of skin and subcutis extending the whole breadth of lid, and as wide as seemed possible without danger of shortening the lids, was excised from each eye. There was considerable postoperative swelling and the lids remained puffy. Three months after the operation there was still much swelling, and a great number of fine whitish spots and numerous small dilated superficial venules were seen in the skin of both upper lids. The patient was last seen June 26, 1922. Her condition was unchanged and her lids were still markedly puffy as is seen in the photograph taken at this time.

General medical examination revealed no evidence of cardiac or renal trouble, nor of myxoedema.

PATHOLOGICAL EXAMINATION.

(4489) The material examined consisted of two long narrow strips of skin and subcutaneous tissue, one from each upper lid. After formalin fixation one piece was embedded in celloidin, sections were stained in haematoxylin and eosin and also in Verhoeff's elastic tissue stain. The other piece was embedded in paraffin and sectioned at the laboratory of the Army Medical Museum to which we are indebted for several sections. The material from both lids showed identical lesions.

The epithelium is slightly thinned being about four cells deep with a covering keratinized layer which varies from 5-15mm in thickness. Quite striking is the uniformity in thickness of the epithelium which remains almost constant throughout all the tissue examined, forming a marked contrast to the normal where the epithelium often varies by 1-2 times its thickness within the same low power field. There is an almost complete absence of the interpapillary epithelial downgrowths. A large number of the basal cells and a much lesser number of the prickle cells exhibit marked swelling and vacuolization, a vacuole at times attaining such size as to press the nucleus into a narrow sickle shaped band along one cell margin.

The corium, like the epithelium, is of less than normal

thickness, and is of far less dense structure than normal. Instead of the almost uniform fibrillated tissue which one usually sees, the individual fibers of which are not easy to distinguish, the stroma here consists of fiber bundles almost every one of which is clearly separated from the others.

Special stains for elastic fibers do not reveal the dense whorls of these fibers often found in normal tissue, but on the other hand, the number of elastic fibers normally varies within wide limits and places can readily be found, in the normal, showing quite as little elastic tissue as any parts of the tissue we examined.

The subcutis partakes of the same general changes as the corium. Numerous large extravasations of blood are found in the corium and subcutis, but these are no doubt due to the operation of removing the tissue. The hair follicles, sebaceous and sweat glands are normal.

The outstanding pathological feature of the tissue is to be found in relation to the blood vessels, especially the capillaries and smaller venules. There is, first of all, an increase in the number of vessels, most of which are dilated and filled with corpuscles. Some of the endothelial cells of the smaller venules are swollen and bulging into the lumen, their protoplasm stains feebly and at times contains vacuoles, and their swollen pale nuclei appear oval even on cross section, instead of flattened, fusiform, or crescentic. About many of the smaller venules there is a sheath of cells far more numerous than normally found, and many of these cells partake of the same pale staining swollen and even vacuolated appearance as the endothelial cells just described. Their finely reticulated protoplasm makes a syncytium, and this syncytium sometimes forms bridges with the protoplasm of the endothelial cells lining the lumens, thus proving the origin of the cellular proliferation.

As one proceeds along a venule toward its capillary sources this perivascular cell accumulation irregularly increases and often widens out into a thick tuft of cells about the smallest venules or even about a capillary. In these tufts one sees quite clearly what has been only suggested elsewhere along the vein, namely a coalescence of the vacuoles of these proliferated endothelial cells to form new capillary channels so that the tuft often suggests the appearance of a kidney glomerulus. All gradations of cell forms are seen from the swollen pale cells with round or oval nuclei and finely reticulated protoplasm which form a syncytium, to flattened and normal looking capillary endothelium. In spite of careful search no mitotic figures are seen. Scattered among these cells are numerous chromatophores whose pigment is evidently not haematoxylinous since it is decolorized by

potassium permanganate followed by oxalic acid, and fails to give an iron reaction with potassium ferro- or ferri-cyanide.

These masses of proliferated cells vary greatly in size and complexity. They are very numerous, and accompany almost every capillary and venule in the corium, so that no high power field is free from them, and they thus make up a considerable part of the bulk of the tissue. They are found not only scattered throughout the connective tissue, but also very frequently about a hair follicle or gland, in which case they no doubt arise from the capillary net which normally surrounds these structures.

DISCUSSION.

The first pathological study of this condition was made by Fehr (6) who called attention to the marked atrophy of all parts of the skin, the loss of the interpapillary epithelial down-growths and the dilatation of the vessels. He noted the pigment bearing cells and suggested that the pigment might be haematoxylinic. The elastic fibers, he said, were normal in number, but of less than usual thickness.

Subsequent observers have in the main confirmed Fehr's findings though the question of the number and size of the elastic fibers has been debated pro and con, and though Weidler (18) claimed to find no changes at all except an oedema of the corium and a slight round cell invasion of the tissue.

Much attention has been given to the blood vessels which most observers agree are dilated and increased in number. Rohmer (13) reporting on four cases stated that the dilatation of the blood and lymph vessels was the outstanding feature of the condition and proposed the name "Angiomégalie symétrique des paupières supérieures." v. Michel (11) describes in addition to the usual findings a "perithelial proliferation" and gives a drawing showing a condition not unlike that which we have found. Likewise Stieren (17) noted that "the walls of the blood vessels were uniformly rich in spindle connective tissue cells. Those which ordinarily should be of capillary type had an adventitia one to two cells broad. In short there was a general hyperplastic condition of the cutaneous vessels with marked increase in their number." There can be no doubt that along many of the vessels the appearance is produced of a perithelial (adventitial) rather than an endothelial

proliferation, but the fact that these cells in places form a definite syncytium with the endothelium, and that amongst them one finds many new formed and forming capillaries leaves little doubt as to their endothelial origin.

We have, then, in this case a diseased condition of the endothelium of the capillaries and venules, manifesting itself in a swelling and proliferation of the endothelial cells. There is, of course, no proof that this is the underlying cause of the whole pathological picture, but it is natural to suppose that endothelium so diseased might exhibit an altered permeability, and might thus by impairing nutrition engender the atrophy and oedema of the epithelium and corium that has been so frequently described. Some additional weight is given this supposition when one remembers that blepharochalasis has been known not infrequently to develop after repeated attacks of angioneurotic oedema. The latter has, at any rate, been generally assumed to be a vascular or vaso-motor disturbance.

v. Michel (11) believes that the pathology of blepharochalasis relates it to so-called "acrodermatitis progressiva chronica," (Herxheimer and Hartmann (20)), in which he quotes Rusch (21) as describing a combination of chronic inflammation and atrophy. In our case there was not the slightest evidence of any chronic inflammation though the endothelial proliferation might conceivably be mistaken for a perivascular infiltrate. We have not had the opportunity to examine sections of skin showing acrodermatitis progressiva chronica and cannot, therefore, venture to guess whether the same pathological picture exists in that condition.

BIBLIOGRAPHY.

1. AYERS, W. McL. *Lancet Clinic*, Dec. 13, 1913.
2. BACH. *Arch. f. Augenheilk.*, v. liv., p. 73.
3. BLACK. *Ann. of Ophthalmology*, v. xxiv., p. 404; v. xxv., p. 399.
4. BOYD. Abstracted in *Ophthalmic Year Book*, 1916, v. xiii., p. 297.
5. DALEN. *Mittheilungen aus der Augenklinik des Carolinischen Medico-chirurgischen Instituts zu Stockholm*, 1902.
6. FEHR. *Centralbl. f. prak. Augenheilk.*, 1898, v. xxii., p. 74.
7. FUCHS. *Wien. klin. Wochenschr.*, 1896, No. 7.
8. LODATO. *Arch. di Ottalm.*, v. xi., p. 42.
9. LOESER. *Arch. f. Augenheilk.*, 1908, v. lxi., p. 252.
10. v. MICHEL. *Berliner Ophthal. Ges.*, Sitz. 5, 1906, I., 18.

11. v. MICHEL. *Graefe-Saemisch Handb. d. gesamt. Augenheilk.* 2nd Ed., v. v., Part 2, p. 130.
12. RANDOLPH. *Trans. Amer. Ophthal. Soc.*, 1916, v. xiv., Part 2, p. 518.
13. ROHMER. *Arch. d' Ophthal.*, July-Aug., 1900.
14. ROLLET and GRENET. *Cliniques Ophthal.*, v. xix., p. 535.
15. ROSENSTEIN. *Berliner Ophthal. Ges.*, Sitz. 5, 1902, II., 27.
16. SCRINI. *Arch. d' Ophthal.*, v. xxvi., p. 440.
17. STIEREN. *Trans. Amer. Ophthal. Soc.*, 1914, v. xiii., Part 3, p. 713.
18. WEIDLER. *Trans. Amer. Med. Assoc., Section Ophthalmology*, 1913.
19. WEIDLER. *N. Y. Jour. Med.*, v. xvii., p. 468.
20. HERXHEIMER and HARTMANN. *Arch. f. Dermat. u. Syph.*, lxi.
21. RUSCH. *Arch. f. Dermat. u. Syph.*, lxxxi., p. 3 and 313.

THE THERAPEUTIC USE OF UVEAL PIGMENT IN SYMPATHETIC OPHTHALMIA.¹

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THE basic clinical points thus far emphasized in our work (1) (2) have been these. 1. That the occurrence of an immunity against uveal pigment protects against the development of sympathetic ophthalmia. 2. That the outbreak of sympathetic ophthalmia is dependent upon an existing hypersensitiveness to uveal pigment. If these two fundamental points hold true, as it appears they do, they point at once to two very definite measures, preventative and therapeutic procedures, as regards sympathetic ophthalmia. The two measures are these. 1. As a preventative or a prophylaxis against sympathetic ophthalmia, the obvious procedure is to remove the hypersensitivity and produce the desired immunity. 2. As a therapeutic measure, to remove the one factor which appears essential to the outbreak of sympathetic ophthalmia and to substitute for it, the one factor that appears to make sympathetic ophthalmia impossible; in other words again to remove the hypersensitiveness and produce an immunity to uveal pigment.

With the use of uveal pigment as a prophylactic measure we have had no experience. The case reported below is also the only instance in which we have used the pigment as a

¹ Presented before American Ophthalmological Society at Washington, May 3, 1922.

therapeutic agent. It may be stated frankly that insomuch as this work is scarcely out of the experimental stage, that we felt considerable reluctance in using uveal pigment in man, knowing a hypersensitivity to it existed, unless the circumstances surrounding the case were such as to make any procedure that offered the least hope, justifiable. The case below reported more than filled these conditions. Before any injections were made, Professor Hans Zinsser was good enough to consult with us, and it was only after this final consultation that the procedure was undertaken.

REPORT OF A CASE OF SYMPATHETIC OPHTHALMIA.

The patient was a boy, aged 8, who was seen on September 10, 1921, with an unhealed corneal ulcer with prolapse of iris in a dense scar occupying the lower half of the right cornea, the result of a gonorrhreal conjunctivitis, which began three months previous. Vision was reduced to light perception and the tension was increased. The attempt to preserve the eye seemed justified; on September 13th an iridectomy was done upward, the defect in cornea was curetted, the prolapsed iris removed as well as possible and the corneal wound was covered with a conjunctival flap. This healed and patient returned to his home after two weeks with vision of $\frac{1}{10}$.

He returned on October 31st, because the other (left) eye had become red three days before. The left eye showed slight ciliary congestion, posterior corneal deposits, posterior synechiae. V. $\frac{1}{10}$. Tension n. Interior n. The right eye was white. V. $\frac{1}{100}$. The area of the corneal defect covered by a conjunctival flap was depressed and ocular tension was reduced.

There was no history of indigestion or overeating; urine was normal; stool showed evidence of intestinal fermentation, and the patient was placed on a sugar- and starch-free diet and high colon irrigations. The eye was given the usual treatment. November 7th, V. $\frac{1}{10}$; vitreous hazy; retinal veins engorged. November 9th, right eye enucleated. Serum reaction against uveal pigment was negative, showing no immunity whatever. A large cyanide subconjunctival injection was given; pilocarpine sweats and mercurial inunctions were begun. November 14th, atropine eczema. Left pupil contracting; nodules appearing in iris. Leukopenia 3000; no lymphocytosis. December 8th, V. $\frac{1}{10}$. Deep ant. chamber. Iris flat with nodules. Optic nerve

blurred, retina hazy. Non-specific protein therapy was started, a course of typhoid vaccine being given by Dr. Bonime. Though these were followed by the usual reactions, the leucocyte count did not increase and the eye continued to grow steadily worse. There was a marked follicular conjunctivitis with pseudo-membranes. The general treatment was then changed to salicylate of soda in large doses. The eye showed more and more the characteristic changes of sympathetic ophthalmia with nodules in the iris; peripheric retraction of iris; complete synechiaæ and capsular opacity in the lens. January 5, 1922, the injections of uveal pigment were commenced. The progress of the eye disease did not seem to be particularly changed. Anterior chamber was shallow; pupil contracting; iris uneven, flat total adhesion; tension increased. January 18, 1922.—The eye was better; cornea and iris were clearer. T. 36. This improvement was only of brief duration and exacerbation occurred on February 2, 1922, when the eye became more red, harder, and there was more exudation in the anterior chamber and in the iris. On January 20, 1922, eight days after the course of immunization was completed, the serum reaction had become + +, almost complete fixation. Following the exacerbation of February 2nd the eye gradually improved, became white, and free from inflammation though lenticular condition remained about stationary; iris retracted with some anterior peripheric adhesions; capsular opacities. Tn. V. $\frac{2}{200}$. Details in fundus not visible. The blood examination on February 8th was + + +, showing complete fixation.

TECHNIQUE OF TREATMENT.

Procedure with Uveal Pigment.—The suspension of pigment used in the case was made up as before described (3) and preserved with 0.15% tri-cresol. Insomuch as the pigment is denaturized by heat, unheated pigment was given, the only step taken for active sterilization being the addition of tri-cresol, which is sufficient to destroy all ordinary non-spore forming pathogenic organisms. The critical condition of the case did not allow sufficient time to undertake animal experiments to exclude the remote possibility of the presence of tetanus spores. Therefore a precautionary intradermal test was made with tetanus antitoxin. This was positive, and the patient was desensitized with serum in the usual manner, and then given 1500 units of tetanus antitoxin. An intradermal skin test with uveal pigment was then made.

Technique of Intradermal Test (January 6, 1922). Three

different dilutions of the normal pigment suspension (the pigment of one cow's uveal tract to 7.5cc of salt solution is called "normal"), were used. The solutions were 1:100, 1:50, and 1:10. Using a fine hyperdermic needle small intradermal injections, sufficient to raise a bleb about one half the diameter of a dime, were made with each dilution on the flexor surface of the forearm. A control was made with 0.15% tri-cresol in normal salt solution. At the end of one hour the three blebs where the pigment suspension had been injected were surrounded by a striking, confluent, urticarial, weal, while the control was practically negative. Within six hours this urticarial reaction had disappeared. Since the patient was strikingly hypersensitive to uveal pigment, we at once proceeded with desensitization.

Technique of Desensitization (January 6, 1922.) Intramuscular injections in the buttock were made at two-hour intervals. The so-called "normal" suspension was used for the first four doses. The amounts given were 1.0cc; 1.5cc; 2.0cc and 2.5cc. For the fifth injection a suspension of twice normal strength was used, 2.5cc (the equivalent of 5.0cc of the normal) were given. There was no essential change in either the blood pressure, pulse, temperature, or respiration during this period of desensitization. The only change observed was a generalized urticaria with the resultant unpleasant itching. This was relieved by 70% alcohol rub, and entirely passed within sixteen hours.

Technique of Immunization. On January 6th, during desensitization, a total of 12cc of the normal suspension had been given, the last injection being the equivalent of 5.0cc of the normal. On January 9th, the equivalent of 7.5cc of the normal (condensed in a bulk of 2.0cc) were given by intramuscular injection in the buttock. On January 12th after a second three-day interval, the final injection, the equivalent of 10cc of the normal, was given by intramuscular injection in the buttock. Like the previous injection the pigment was condensed in a total volume of 2.0cc. No untoward symptoms accompanied either of the latter injections.

COMMENT.

Sympathetic inflammation after perforating ulcers is rare, although Peters (4) comments on the fact that sympathetic ophthalmia has been more frequently observed after perforation of a corneal ulcer complicating a gonorrhreal process, and concludes the conditions in gonorrhreal inflammation are more favorable to a development of sympathetic ophthalmia than

in other keratitides. As an operation was performed on some cases mentioned by him and it may be that the prolapse is not so dangerous as the operation which was undertaken to remove it. The operations performed in these cases (quoted from Peters) were excision of prolapse (Schieck, Brown), cauterization (Troussseau, Gifford, and Fuchs), abscission of corneal staphyloma and conjunctival suture (Fuchs).

In the above described case there seemed to be a definite intestinal autotoxæmia. No change in diet or treatment, however, was of any avail. There was no lymphocytosis. Recent investigations on the occurrence of lymphocytosis in sympathetic ophthalmia are negative. Treatment with non-specific protein therapy was without avail. A leucocytosis could not be obtained.

Enucleation after onset of sympathetic ophthalmia was, as usual, without influence on the course of the iridocyclitis in the remaining eye.

Microscopic examination of the primary eye showed a characteristic diffuse infiltration of the iris and the adjoining iris angle, with mononuclear lymphocytes, a moderate infiltration of the ciliary processes and neighboring vitreous body, and only a few scattered foci in the choroid.

Inasmuch as partial recoveries have frequently been observed in sympathetic ophthalmia, irrespective of the form of treatment, the inflammation having exhausted itself, it is unwise to draw any definite conclusion from one case. In this patient, after desensitization and immunization, the clinical course, with one slight and short period of exacerbation, came to a standstill. The eye became white and free from inflammation and has so remained.

SUMMARY.

Uveal pigment was used as a therapeutic agent in a case of sympathetic ophthalmia. The case occurred in a boy, aged eight years, following an operation for a perforated corneal ulcer, with prolapse of iris, occurring after gonorrhœal ophthalmia. The inflammation pursued a steadily progressive course with all the symptoms of the severe type of sympathetic disease. All usual types of treatment—diet, intestinal

irrigations, pilocarpine sweats, mercurial inunctions, large doses of sodium salicylate, and non-specific protein therapy were without any effect.

The serum reaction to an antigen of uveal pigment was completely negative. The intradermal reaction to uveal pigment was strikingly positive, showing a marked hypersensitivity to pigment. The treatment with uveal pigment consisted in desensitization, followed by active immunization. After the immunization, the serum reaction against uveal pigment became strongly positive. Synchronous with this, with one short period of acute exacerbation, the inflammation in the eye subsided, the eye became white and has so remained.

The active process lasted for three months and has now been stationary for three months. Vision = $\frac{6}{60}$. The eye is white and free from inflammation but shows peripheric retraction, adhesion of the iris, and capsular opacities. Tension is normal.

BIBLIOGRAPHY.

1. WOODS, A. C. "Immune Reactions Following Injuries to the Uveal Tract." *Journal of A. M. A.*, 1921, lxxvii., 1312-1321.
2. WOODS, A. C. "The Diagnostic Use of Uveal Pigment in Injuries of the Uveal Tract." *ARCHIVES OF OPHTHALMOLOGY*, 1922, LI-451.
3. WOODS, A. C. "Ocular Anaphylaxis IV. The Antigenic Properties of Uveal Pigment as Shown by Complement Fixation." *ARCHIVES OF OPHTHALMOLOGY*, 1917, xlvi, 503.
4. PETERS. *Graefe-Saemisch Handbuch*. Hess III, Edition.

THE PLACE OF OPHTHALMOLOGY IN THE UNDER- GRADUATE MEDICAL CURRICULUM.¹

BY DR. W. GORDON M. BYERS, MONTREAL.

"In education, most time is to be bestowed on that which is of the greatest consequence in the ordinary course and occurrences of the life the young man is designed for."

LOCKE.

WHAT part of ophthalmology shall be taught in the undergraduate medical course? How much time shall be devoted to the subject? These are important questions; for in seeking to determine the place of ophthalmology in the undergraduate medical curriculum, one is faced at the outset, not only with the problem of what to do with the specialties in general, but also with the whole problem of undergraduate medical teaching.

A great deal of time and thought has been advantageously devoted in recent years to the subject of post-graduate ophthalmic studies, but apparently very little by comparison has been given to undergraduate work. The reason probably is, that the post-graduate studies present a circumscribed field that falls largely to teachers in the specialties for solution, while undergraduate studies in any one subject are but a single factor in a much larger problem, in which workers in all the branches of medicine are interested.

It seems a duty for ophthalmologists to take part in the wide-spread deliberations that are shaping the policies of all medical schools; especially so as some of the proposals that have been made in regard to the disposition of special studies are obviously

¹ Read before the American Ophthalmological Society, Washington, May 2, 1922.

founded upon a misconception of values and of the primary purpose of undergraduate medical education.

Before beginning the study of the problem we must set clearly before ourselves exactly what we wish to accomplish in undergraduate teaching. We still touch hands with those for whom it was possible in their college years to gain a fairly comprehensive grasp of the whole range of the medical knowledge of the time; but the phenomenal development of medicine during the last few decades has made this less and less attainable. Students are now forced to confine themselves to phases of the old major subjects, to subjects of recent development, and even, again, to ramifications of them. We have, in a word, witnessed an extraordinary development of specialization. The problem of undergraduate work is today, therefore, much more complex. Men aim not at one goal, but aspire to varied fields of endeavor.

As a starting point we must classify students in accordance with what they have in view. This is not a difficult matter, for quite simply our students fall into three groups: Those who are destined to be general practitioners; those who will be clinical specialists; and those who will specialize in research, teaching, and public health.

The specific business of the general practitioner is to treat sick individuals, in other words, to grapple with distinctive medical problems. Some of these problems are of little or no moment; others are of vital importance; and many of them are clearly beyond the scope of the general practitioner. It is obvious that in order to see clearly what are the requirements of the general practitioner in the way of instruction and training, we must set forth his problems and make some kind of classification in accordance with their relative values.

Clearly, the only standard of classification one can adopt in this field is the bearing problems have upon the preservation of life and of function. On this basis medical disorders can be instantly separated into those that menace life, and those that do not menace life. The second division, disorders that do not menace life, can be subdivided into disorders which threaten complete and permanent disablement, and those which do not threaten complete and permanent disablement. The first subdivision, disorders which threaten complete and permanent

disablement, includes two sets of conditions, those which call for immediate recognition and immediate and effective interference, and those which do not call for immediate recognition or immediate interference. The second subdivision, disorders that do not threaten complete and permanent disablement, embraces three classes; those which involve temporary disability but tend always of themselves to recover; those which do not involve temporary disability but cause discomfort in varying degree and lower efficiency; and those falling in the field of congenital deformities and cosmetics.

Although this classification is not intended for more than a suggestion, it yet suffices to throw into relief the relative importance of the disorders by which the general practitioner may be faced. But the classification covers the whole range of the problems of medicine and surgery; and since no man can at this day hope to master the entire subject, it must be determined which part of it the general practitioner can reasonably be expected to manage.

It is evident that the foremost place must be accorded to those disorders that carry with them a menace to life, namely, hemorrhages, suffocations, serious fractures, strangulations, virulent infections, poisonings, and cancerous growths. Scarcely less important are the conditions that lead to complete and permanent disablement, that deprive a man of his active life in society. No one will question the assertion that this state is regarded by mankind as among the great tragedies of life. Under these two headings are what may be called the major problems of medical practice. These problems vary in their degree of urgency, but they demand of the practitioner a knowledge so complete that it will express itself in immediate and fully effective action. Delay and partial recognition mean death and disaster.

On the other hand, it is equally clear that, in a field that cannot in any event be fully covered, the disorders that do not threaten complete and permanent disablement are those which should receive least consideration. At their head stand those conditions which are either extremely rare, or require for their management a training beyond the power of the student to acquire. These belong of necessity to the province of specialization. If we eliminate these, as we reasonably must, we

reduce the problems of our second division to a group made up largely of what we may call the minor ailments, that is, disorders which are neither menacing, complex, nor rare, but assume a certain importance because of the frequency with which they recur. In this minor field, then, and in the major field of menacing disorders lie the problems that fall with reason to the general practitioner.

The segregation of his problems in this way reveals the educational requirements of the general practitioner. A distinctive problem in the field of practice implies in a broad sense a distinctive scholastic task. We are able through our classification of medical disorders on the basis of what is of most importance, to design an undergraduate curriculum in accordance with the principle of what is of most worth. This principle requires on the one hand that the range of problems as determined shall shape the studies underlying their comprehension, and, on the other hand, that the amount of time and attention given to the mastery of a problem shall be proportionate to its importance as fixed. Major problems must always take precedence over minor problems, to the extent of entire neglect of the latter, if time be limited.

What applies to the design of the curriculum as a whole, applies to the individual studies. This answers the question as to what part of the subject shall be taught. The time devoted to a subject is to be determined in accordance with this decision. The place of a subject in the undergraduate medical curriculum, the place of ophthalmology, for example, will be proportionate to the number and character of the problems which fall to it from the whole number as determined. These conclusions lead us to see how illogical is the practice of devoting an equal amount of time to the specialties simply because they are so classified, instead of apportioning time on the basis of relative values. They also dispose of the proposal that the specialties as such should be entirely eliminated from the undergraduate curriculum, to the end that the whole time available may be devoted to the major subjects.

In illustration of what has been said let me indicate the disorders that must shape the undergraduate course in ophthalmology for general practitioners:

MAJOR PROBLEMS.—I. Disorders that menace life: intra-

ocular tumors; malignant growths on and about the eye; wounds and injuries of the orbit; orbital cellulitis and osteitis from extension, or metastasis. The student should have knowledge of, and be able to distinguish between, the various disorders, of which exophthalmos or proptosis is the most striking sign.

2. Disorders that do not menace life but are signals of disorders that menace life: optic neuritis, or "choked disk"; the various types of systemic retinitis and choroiditis; paralyses of the intrinsic and extrinsic muscles of the eye; visual disturbances expressive of disease in the optic tract.

3. Disorders that threaten complete and permanent disablement, and call for immediate recognition and immediate and effective interference: the purulent ophthalmias; trachoma; pterygium rarely; phlyctenular conjunctivitis; tubercular and diphtheritic conjunctivitis; ulcer of the cornea; interstitial keratitis, wounds, and injuries, and burns of the eye, including foreign bodies, or the field of industrial accidents; iridocyclitis, panophthalmitis; sympathetic ophthalmia; glaucoma; optic neuritis, of local origin, or axial; dacryocystitis; myopia.

MINOR PROBLEMS.—Sties, chalazions, marginal blepharitis, chronic catarrhal conjunctivitis.

It will be noted that, apart from numerous other harmless and rare conditions, one excludes from this list almost the whole series of cataracts and congenital anomalies. Implied, too, is but a limited acquaintance with the subject of muscular anomalies; and the operative field is highly restricted. On the other hand, the work demands a fair mastery of refraction, ophthalmoscopy, and perimetry in the functional examination of the eye.

If we were dealing solely with the ophthalmic course, the problem of how to present this work would not be difficult, but in undergraduate teaching we must view the matter from the standpoint, not of one but of all the subjects composing the undergraduate curriculum. Admitting that at the moment, and still more in the future as medicine develops, problems from the field of general practice must fall into the fields of specialization, when we come to include all that bear on general practice we are confronted by what is apparently a task of great magnitude. Nevertheless, this principle of what is of

most worth leads us to conclude that at any given time the maximum feasible achievement in the field as outlined shall be the minimum requirement in the way of a curriculum for general practitioners.

Now, professedly, the colleges undertake to cover this field; but we know only too well how far they fall short of meeting the requirements,—that there are annually graduated, in large numbers, men who are quite incapable of undertaking what should reasonably be expected of them in the field of general practice. I shall not now occupy your time with an analysis of the causes of this lack of success. Mainly it has been due to failure in recognizing the diversity of aims that has arisen; to efforts that have been made to develop unduly the purely educational aspects of medical studies; as well as to the introduction of "cultural" subjects that are clearly outside the province of a medical curriculum. The consequence of this confusion of ideals has been to graduate men on the one hand with an inadequate knowledge of important problems and of the subject as a whole; and on the other hand with an unnecessary knowledge of minor problems and of things outside the practitioner's field. Because of the insuperable difficulties of the curriculum, practical training has been neglected; facts have usurped the place of principles; and knowledge the place of education.

The consciousness of failure is a matter of concern and dissatisfaction to teacher and graduate alike; but behind the faculties and behind the practitioners is a third group whose interest in this matter has been apparently overlooked. In the end, medical education is a trust imposed on the schools and colleges of the country by the public, and one does not need to put one's ear close to the ground to learn that there is discontent with the manner in which practitioners are being trained to deal with the emergencies that arise in the community. From every point of view, therefore, the situation demands redress.

A curriculum designed in accordance with the decisions that have been reached offers a helpful measure for the solution of the difficulties. Taking the practitioner's problems as listed we shall develop courses of study that will cover as nearly as possible, not only the field as a whole, but what the

student is expected to know of each individual problem. It is implied that at the beginning of each course the student shall be given printed notes or a synopsis of the work to be done. Assistance may be had from the different departments; but in the end everything is to be carefully considered and brought into conformity with a prearranged plan. This work ought really to be entrusted to a small group of men, vested with considerable authority; and I suggest that it would be helpful for them to think of the problems, not as belonging to the various fields, but rather to medicine and surgery—to the mother subjects—as indeed they do.

Particularly important is the fact that under a unified direction it would be possible through coördination to eliminate completely the wasteful overlapping that now prevails, as well in the primary as in the final subjects. This process should be extended to its logical limit, through subject and problem to phase and element. It ought to be determined at the outset, in every instance, when and by whom a subject of this kind is to be taught. Students should be required to master a problem as defined, once and for all, and having mastered it pass to something else. On completion, the scholastic tasks would be distributed among the various subjects making up the curriculum. It really does not matter who does the teaching, though expediency would probably demand the services of experts in the special fields.

While what I have said applies particularly to the clinical subjects, which must be regarded as the basis for any arrangement of a curriculum, it also holds for the primary subjects; for the function of all primary teaching is to build concepts for the clinical work. The great fundamental principles will be taught as before; but with a classification of problems on the basis of what is of most worth, there will come to the primary teachers a scale of values that will be most helpful, as clearly indicating where emphasis should be laid in their work of preparation. It is not to be expected that all this could immediately be effected. Many difficulties can be foreseen. Adjustments and readjustments would be necessary; but eventually, with not one but many centers participating, there would develop a more or less standardized curriculum, which might be universally adopted.

But the adoption of a minimum medical curriculum implies certain specific obligations. One is, that the student must know everything of the subject as presented. It will not suffice that he recognize but two out of four essential problems; that he know but half of what is expected of him to learn of any one problem. This suggestion demands a very thorough system of examination, under which accurate and continuous records are kept of the work the student has done and the success with which he has done it.

A second and equally important obligation is, that if a specified task is set the student, the subject must be fully and systematically presented to him. With exceptions, of course, clinical instruction in medicine is still largely and generally of a haphazard character and based on chance. By this I mean that in many clinics cases are used for teaching as they appear, without any thought of fitting them into a well defined curriculum. The practice is largely the outcome of a want of clear conception of the field to be covered. The result is, that the students either do not see examples of disorders with which they should be familiar, or that the subject may be presented a quite unnecessary number of times. All clinical teaching should, from the outset, be brought into strict alignment with courses previously defined. This second obligation has also a very important bearing on the existence of a college; for no school is justified in carrying on clinical teaching, if the community in which it is situated is not sufficiently large to furnish clinical material of the right kind in adequate amount.

But if, in its application, the principle of most worth brings a more circumscribed, yet equally comprehensive curriculum, it demands on the other hand a more thorough practical training. Granting that the most is made of the facilities afforded by the dissecting room, the post-mortem room, and operative courses on the cadaver (and it is not), we are bound to admit that attendance on hospital work as now generally practiced does not produce satisfying results. Training to be effective must be much more intimate. There is daily evidence of the rapidity with which graduate internes are trained to deal competently with problems that are entirely beyond the scope of the man who leaves college immediately to enter practice. We must strive to secure for our students similar facilities in

their undergraduate years. The hospitals at present engaged in teaching could with advantage to the work of the institution add greatly to the number of internes; but when the limits are reached, a great field of opportunity for practical instruction remains.

Arrangements with non-teaching hospitals in college centers, as well as with numerous hospitals in centers which do not support colleges, could undoubtedly be made to share in the practical instruction of students. This means the training of the staffs of these institutions, who would then take rank as extramural teachers. The value of this enlarged opportunity for training to the colleges and to the student is apparent; and the benefit that would accrue to the community, through the raising of the standard of practice in this way, is scarcely to be estimated. The hospitals of the entire country might advantageously be utilized for this purpose. The suggestion implies in a broad and more modern sense a return to the old system of apprenticeship. Just how this idea would work out could not be determined until the curriculum as a whole had been developed. The main difficulty would be in arranging a plan of rotation. The housing problem would only be a matter of subsidizing the institutions to enable them to erect the necessary residences. Maintenance, in any case, would fall on the shoulders of the students.

More seriously to be considered is the objection that the work as outlined would occupy more time than men could afford. There is no reason, however, why theoretical instruction could not be concomitantly and even more advantageously carried on during the period of residence. Then, too, the time necessary to cover the field would be less than would first appear. Careful work in medicine paves the way for accurate diagnostic work in surgery, and the general training in surgical technique and procedure goes a long way to make easy the difficulties of the specialties. The general principles and the technique cover the whole field. Moreover, when one has mastered the major problems the minor problems present no difficulties.

Speaking for ophthalmology, I am satisfied that in the case of a man who has had a year of active work in general surgery, one could give him a satisfactory training in the course as outlined for general practitioners, in approximately four months'

whole time work, the necessary instruction in refraction and in ophthalmoscopy included. The ophthalmic operations falling to the general practitioner in accordance with the decisions formulated, are few in number including as they do only enucleation of the eye, exenteration of the orbit, drainage of the orbit, opening of lacrimal abscesses, styes, and Meibomian cysts, removal of foreign bodies from the cornea, cauterization of the cornea, and an iridectomy for the relief of glaucoma and for incarcerated iris. The last mentioned is the only one that presents any difficulties; but these could be largely overcome by practice on dead animals' eyes.

But before estimating what, if any, additional period is necessary for practical training, note should be taken of the saving of time that can be effected in various ways for this purpose by the utilization of time that is still largely wasted in attendance on operative clinics, the details of which are entirely indiscernible; by the ruthless exclusion of everything that is obsolete and trivial and irrelevant; but most of all by a rearrangement of the present curriculum as I have suggested, as well as by the introduction of more effective methods of teaching and study that grow out of this work. In the last analysis the argument calls for a matriculation standard that shall be no more than adequate if time demands consideration.

A few final words about undergraduate optional courses and specialization are now required. Under the plan as outlined, the scope of the curriculum would be much more sharply defined; and it ought to be possible, in a measure at least, to grade students and to permit the more brilliant among them to proceed to advanced work in optional courses after satisfying the faculties that they had mastered the information of a minimum curriculum.

But specialization in undergraduate years is unthinkable. The interdependence of the various systems of the body being so well established a fact, it is clearly impossible that a man could intelligently practice in any special field without a knowledge of medicine and surgery as a whole. The only guarantee against narrowness of view, the bane of specialization, is a broad theoretical training. On the other hand a general surgical training is the corrective for meticulous and careless methods in the special operative field.

Finally, from the point of view of public necessity—and that must always be the last court of appeal—it is not to be tolerated that men trained in limited fields of medicine shall be given the right to practise the art as a whole; for, there is no guarantee that men so trained will always succeed, or that later they may not wish to establish themselves as general practitioners. The only conclusion is, that men must qualify fully as physicians and surgeons before becoming specialists.

A SIMPLE OPERATION FOR PTERYGIUM.

BY DR. L. W. CRIGLER, NEW YORK.

(*With two illustrations on Text-Plate XXIII.*)

SUFFICIENT has already been written concerning the origin and histological structure of pterygia to make a further review of the subject at this time unnecessary.

Fuchs in his exhaustive investigation, has established the fact that the growth is never preceded by an ulcerative process, but that it is a hyperplasia superinduced by the irritation resulting from a pinguecula, a peculiar form of degeneration of the exposed ocula conjunctiva, adjacent to the cornea usually on the inner side.

Any encroachment of the conjunctiva on the cornea at any other portion of the periphery is due to corneal inflammation or ulceration, and this we classify as pseudo-pterygium.

With this knowledge clearly in mind it would seem that the only rational treatment must consist in not only a removal of the head of the pterygium, but the body as well, since it is this degenerated structure which precedes the development of the pterygium; also it would seem advantageous to divert from the interpalpebral space that portion of the conjunctiva immediately adjacent to the diseased structure removed, by drawing it down beneath the lower lid, thereby affording protection against subsequent degeneration and recurrence; and at the same time removing the line of union away from the interpalpebral space.

The operation to be described fulfills the above requirements and has other advantages which will be enumerated.

* Read before the Section on Ophthalmology, New York Academy of Medicine, May, 1922.

Except for an occasional recurrence, all operations for the relief of small pterygia yield good results. Failure is usually due to faulty technique or improper post-operative care. The essentials of success in the operation to be described are:

First.—A thorough removal of the head of the growth from the cornea, from limbus to apex. (The slightest vestige of connective tissue left behind may proliferate and invite an ingrowth of newly formed vessels from the limbus, and thus become the starting point of recurrence).

Second.—Removal of the body of the pterygium and coaping the edges of the wound in such a way as to completely cover the underlying sclera, and unite the wound edges to each other, and to the exposed limbal border.

Third.—Tieing the sutures in a manner to prevent their cutting through the conjunctiva or coming untied prematurely.

Fourth.—Immobilization of both eyes a sufficient length of time to allow for primary union and epithelialization of the denuded corneal surface.

Until three years ago, the writer had been removing pterygia by Arlt's method as described by Meller; it was often found difficult to completely close the conjunctival wound on account of the tension put upon the limbal suture. It would be found frequently at the first dressing, that the suture had cut through the conjunctiva and left a wide surface of exposed, granulating sclera beneath. Again it was found that the sutures would be untied owing to the fact that both eyes were not bandaged, thus allowing free motility of the operated eye. With several recurrences to his credit, a means of relief was sought, and the operation as described below was adopted as fulfilling all of the requirements.

Grasp the neck of the growth with single fixation forcep just at the limbus; with a small narrow pointed knife make a small opening through the upper conjunctival edge of the pterygium immediately beneath the fixation forcep; without removing the fixation forcep make a corresponding opening below.

These incisions should be made just large enough to admit a small flat spatula or Paine's pterygium knife which is passed from the upper through the lower opening, and by blunt dissection the head of the pterygium is removed from the cornea.

If the underlying cornea is not transparent it is evidence that fragments of the growth have been left behind. With sharp scalpel or forceps and scissors, these should be removed.

The body of the growth is next slightly undermined, care being taken not to lacerate the normal conjunctiva at the upper and lower limbal margins. Subconjunctival tissue if abnormally thickened, is dissected from the conjunctiva and removed.

Then beginning at the upper limbal border, an incision downward and inward is made with a sharp pair of scissors, extending to about two or three *mm* of the lower border of the body of the pterygium; next, another incision is made beginning at the lower limbal border and extending inward horizontally to meet the incision from above at an acute angle. (See Figure 1.) All of the growth between these two converging lines is removed. The upper flap now made freely movable by careful dissection from the sclera is drawn down to cover the exposed sclera in the following manner:

Pass a suture through the middle of the upper conjunctiva flap, from without inward, to the limbus below (Figure 2). In placing this suture it is important that the needle be passed through the superficial layers of the sclera at the limbus before coming out through the conjunctiva, as in the advancement operation. This stitch draws the conjunctiva snugly up to the cornea and holds it there without overlapping it. A second suture placed half way between the inner angle of the wound and the limbal stitch, completes the operation. This latter stitch should not include the sclera in its grasp. It is a good plan to tie a third knot in the limbal suture to make sure of its not coming untied. To insure complete immobilization of the eyeball it is necessary to bandage both eyes, and this should be done for at least three days. This may appear trivial to those who have never had failure, but those of wider experience, who have, will appreciate its importance. It insures primary union of contiguous conjunctival raw surfaces and rapid epithelialization of the cornea; conjunctival epithelium blends with corneal at the limbus and the entire wound area is no longer exposed to irritation from without, and the process of healing is uninterrupted. Under such circumstances, recurrence is not to be expected.

The blood vessels in the flap drawn down from above are now directed beneath the lid; the line of union is removed from the intermarginal space, at the same time being covered and protected by the lower lid.

A paper describing an operation, identical in principle with the above, was written by Dr. Campodonico, of Lima, Peru, and printed in the pre-sessional volume of *An International Congress of Ophthalmology*, held in Washington, D. C., May 25 to 28, 1922. Dr. Campodonico did not appear to read his paper, however, and in as much as the operation performed by me differs essentially in the formation of the conjunctival flaps, and was conceived without any knowledge of his work, I feel justified in presenting it.

Dr. Campodonico's experience gained through a practice of his method, in a country in which a great many of the inhabitants are afflicted, has yielded him such uniform excellent results as to cause him to abandon all others. With my more limited experience, I can claim the same good results.

To recapitulate: The advantages of this method are as follows:

The operation is simple and easy to perform, the line of union is removed from the intermarginal space, and at the same time away from the denuded corneal epithelium; the sutures do not tend to cut through the conjunctiva as in the Arlt method, being anchored to the sclera beneath, which insures complete and constant closure of the wound, until firm union has taken place.

A bandage to both eyes for several days insures immobility to the traumatized area, a condition so essential to success after any operative procedure.

A CASE OF NEURITIC OPTIC ATROPHY IN A TABETIC, WITH A DISCUSSION OF THE VALUE OF THE DIFFERENTIAL PUPILLOSCOPE IN SUCH A CASE.¹

BY DR. ARTHUR S. TENNER, NEW YORK.

(*With one figure in the text.*)

History.—The patient came to the Mt. Sinai Hospital, August, 1915, and complained of pains in back and waist. His knee jerks were absent. Romberg positive. Pupillary reactions normal. He had suffered from gonorrhœa some 20 years previous but denied lues. His Wassermann was 4 plus.

In the course of these seven years, he has received 29 salvarsans, and 108 mercury injections. A blood examination, made Nov. 15, 1921, gave a negative Wassermann. The spinal fluid, examined June, 1922, was negative in every respect.

Present status, May 15, 1922.—His vision never troubled him, and it was purely by accident, that I discovered the secondary atrophy about one month ago, in the course of examining a series of luetic cases with the differential pupilloscope.

By the ordinary methods of examination, his pupils reacted to light, the left very well, the right a trifle sluggishly. No anisocoria, or irregularity of shape. Convergence R. good. Yet the figures obtained by pupilloscopic methods showed a distinct lowering from the normal.

It would be beyond the province of this article to give a detailed account of the workings of the differential pupilloscope. Hess (1), Groethuysen (2), and Barkan (3) have done this,

¹ Read before Section on Ophthalmology, New York Academy of Medicine, May, 1922.

and in a later more extended article, I hope to add my observations. A few words of explanation, however, may not be amiss. Hess, realizing the inadequacy of the ordinarily used methods of testing the reaction of the pupil to light and the uncertainty of the conclusions drawn therefrom, differing in the same case often with the judgment of different observers as to whether a reaction is normal or slow or sluggish, and knowing also, as all clinicians know, that these so-called sluggish reactions are frequently physiological, whereas many that would be called normal by most observers are frequently pathological, has devised an instrument which he called the differential pupilloscope. In the application of this instrument, a known quantity (the varying intensity of the light) is used and while the excursions of the pupil are not actually measured, the sensitivity of the iris to lights of varying intensity is. Hess termed this, the "motorische Unterschiedsempfindlichkeit." Barkan translated Hess's term as discriminative acuity but I prefer the term sensitivity, to acuity, as closer to the meaning of "Empfindlichkeit." In addition the term acuity is so closely associated with vision, that it may be misleading.

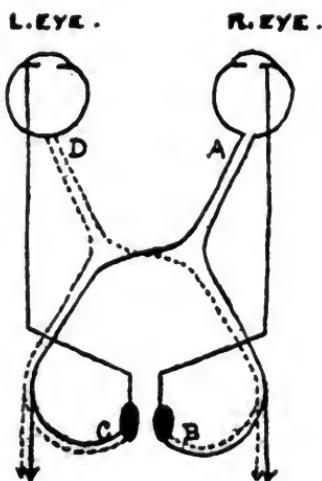
Just as we have been in the habit of testing the direct, and the indirect, or consensual reaction, so the direct and consensual motor discriminative sensitivity is tested and an exact mathematical figure is obtained, which in normal conditions of the retina, optic tract, motor oculi fibers, and nucleus is 0.9 both for the direct and indirect. Under 0.8 is pathological.

In this particular case, the figures obtained were as follows:

	Right	Left
Direct Motor Discriminative Sensitivity	0.55	0.65
Consensual Motor Discriminative Sensitivity	0.75	0.27

Let us analyze these figures in conjunction with the diagram. The figure 0.55 for the direct M.D.S. of the right, indicates a partial blocking of some part of the reflex arc either at A (a receptor or a fiber, lesion) or at B (a lesion of the intercalated fibers), i.e., the connecting fibers between the optic tract and the nucleus of the motor oculi or at both A and B. Similarly the direct M.D.S. of the left eye is 0.65, indicating a

block at D or C, or at both these places. If there was a lesion at B and none at A or D, then the consensual M.D.S. of the



right eye would be equal to the direct M.D.S. of the right eye. But the consensual M.D.S. of the right is 0.75 i.e. 0.2 higher than the direct M.D.S. (0.55) of the right. Therefore, there must be a block at A greater than the block at B. This is confirmed by the low consensual M.D.S. of the left eye (0.27), more than 0.3 lower than the direct M.D.S. of the left, indicating a considerable degree of blocking at A.

The ophthalmoscopic picture confirmed this for it disclosed a marked secondary atrophy of the right disk, with a far less advanced atrophy of the left. The latter still retained some pinkness and the vision of this eye was $\frac{1}{2}$, accordingly we may infer a definite and decided block at A and a slight or no blocking at D.

Ophthalmoscopic examination.—Right—nerve head grayish, margins blurred, excavation and vascular funnel filled up, blood vessels obscured at spots. Left—Disk is pinker in color, but also shows blurring of margins, and covering of face of disk with organized exudate. Fields—Right contracted concentrically to 30 degrees. Left contracted concentrically to 30 degrees. Vision—O.D. $\frac{1}{2}$ —O.S. $\frac{1}{2}$. The diagnosis of a neuritic atrophy of the optic nerves is indisputable.

I wish to call attention to the fact that even without an ophthalmoscopic examination, I was able by means of pupilloscopic measurements, to differentiate and localize three and possibly four lesions of the reflex arc, that is at A (a receptor or a fiber lesion), at B and C, lesions of the intercalated fibers and a doubtful one at D. In other words in the presence of an optic atrophy, an Argyll-Robertson pupil was diagnosed.

The neurological report is as follows: Romberg positive, absent knee jerks, absent Achilles tendon reflex, loss of sense of position. Disturbances of the vibratory sense in legs, testicular hypalgesia, ulnar hypalgesia in both arms. Girdle sensation in upper part of the thorax. Pupillary light reflex present. Diagnosis unquestionably tabes.

This array of characteristic symptoms, convinced the neurologist, that this was an undoubted tabes, but he was somewhat puzzled at the retention of the pupillary light reflex in such a characteristic case.

The Argyll-Robertson phenomenon is present in this case, but only to such a degree that by ordinary methods it does not disclose itself whereas as I have shown, by means of the differential pupilloscope it is revealed, and this in the face of the presence of an additional lesion, that is, an atrophy of the optic nerve.

The secondary atrophy of the optic nerve points to a cerebral lues. Is the spinal condition a true tabes, or a process similar to the brain condition (a spinal lues or a pseudo-tabes)? The latter assumption is not tenable. The persistence of the symptoms after seven years of anti-luetic treatment and the grouping of so many characteristic signs of tabes are against such an assumption and speak for a true tabes.

The coexistence of a tabes with cerebral syphilis may occur, according to Nonne (4), who has found this combination in section, in cases that were also observed clinically. The combination of papillitis, or secondary optic atrophy with tabes, has been reported. Iggersheimer (5) reports his case in detail: In 1904 the papillæ were reddened and blurred. No evidence of tabes at this time. In 1915, the right papilla was definitely atrophic with blurred margins; the left disk had also blurred margins, but normal color. At the same time, the neurologist declared the case one of tabes. In 1917 he had the

good fortune to see this case again. Then both nerve heads were white but the left still had very slight pinkishness. Both margins were blurred and on the right papilla, with the Gullstrand Ophthalmoscope, a definite cloudiness was visible. The neurological examination disclosed an unquestionable clinical tabes.

(There is a rather curious resemblance of my case to that of Iggersheimer's, in that, in both, the right papilla was more seriously affected).

Igersheimer is in doubt as to the classification of his case. At first, he was inclined to the diagnosis of a tabes with a complicating cerebral lues or a pseudo-tabes. Later, he was more inclined to believe that the case was a true tabetic atrophy, in a case with a congenital anomaly of the papilla (blurred margins with cloudiness), (a rather fantastic assumption it seems to me).

Rendu (5) reported a case of clear-cut tabes in which appeared a papillitis, retinal hemorrhages, and vitreous clouding. These cleared up under antiluetic treatment, while the tabetic symptoms and signs persisted, in fact increased.

A similar case was observed by Bernhardt, also one of Mendel and Shuster (5).

REFERENCES.

1. C. v. HESS. "Das Differential Pupiloskop." *Arch. f. Augenheilk.*, 80 Bd., 1916.
2. GROETHUYSEN. "Ueber die Beziehungen zwischen motorischer und optischer Unterschiedsempfindlichkeit bei normalen und krankhaften Zustanden des Sehorgans." *Arch. f. Augenheilk.*, 87 Bd., 3 und 4 Heft.
3. BARKAN. "The Differential Pupilloscope." *ARCHIVES OF OPHTHALMOLOGY*, vol. li, No. 1, 1922.
4. NONNE. "Neuro-Syphilis."
5. IGERSHEIMER. "Syphilis und Auge."

BILATERAL DETACHMENT OF THE RETINA IN NEPHRITIS OF PREGNANCY. RE-ATTACHMENT OF RETINÆ.

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SINCE the appearance of the excellent article by Dr. C. A. Clapp in the July issue of *The American Journal of Ophthalmology*, entitled, "Detachment of the Retina in Toxæmia of Pregnancy," I have been on the lookout for such cases. While the literature upon this subject is small and little mention is made thereof in textbooks, the belief that such cases are not so rare is substantiated by the finding of one more such and its report appears justifiable.

J. M., Italian, multipara, age 31, entered the New Haven Hospital on March 9, 1922. Her family history was negative as to cardiac, renal, or tuberculous disease. She had never had scarlatina, rheumatic fever, or other infectious disease and there was no history of heart trouble. She had had, however, a nephritis during her first pregnancy, which terminated in September, 1914. In January of 1916 she was again delivered, but by a midwife and there is no evidence of nephritis during this pregnancy. Since the last confinement she has had two accidental abortions at the end of the second month.

The patient was seven months pregnant when she entered the hospital. Until within three weeks her health had been good but at that time she had been confined to her bed for a week with cold, sore throat, fever, etc. Two weeks previous to admission her feet, ankles, hands, and eyelids had begun to swell. She had had slight headaches for the past week and occasional obscurations of vision. There was some polyuria but no faintness or dizziness. The symptoms

enumerated had caused her attending physician to send her into the hospital.

Physical examination on entrance showed moderate œdema of eyelids, hands, and abdomen and marked swelling of the legs. She could read fine print without difficulty and had no complaint except of feeling weak. Her blood pressure was 148 , but had dropped to 118 within six hours, only to rise again later. The urine was brown, cloudy, 1.018, albumin 14gms per liter, granular casts 4-7 per field. White count 17,050, Hb. 74%. Wassermann negative. The fluid intake for the first day was 6400cc and output 1800cc. A tentative diagnosis was made of pre-eclamptic toxæmia, probably nephritic.

On the evening of the day of admission the patient complained of slight headache and marked impairment of vision in right eye. (L.P. but cannot count fingers.) Vision in left eye was apparently not involved. Venesection was done next day—400cc—and blood pressure dropped to 190. Because of the gravity of the patient's condition it was deemed necessary to terminate labor and a Voorhee's bag was inserted into the uterus on the evening of the second day of hospitalization. A stillborn baby was delivered the next morning.

The day following the delivery blood pressure was 148 , fluid intake 2000cc and output 1450cc. There was a noticeable decrease in the œdema. On the eleventh day a kidney function test (phenolphthalein) showed 19.87% elimination in two hours. This improved to 38% during the next week. The amount of albumin in the urine decreased slowly but showed a faint trace on discharge, March 29th, twenty days after entering the hospital.

I was requested to examine the eyegrounds of the patient on the day after admission. The fundus of the right eye was obscured in all parts except the lower nasal portion, by a large sacculated detachment of the retina. The small portion not detached appeared to be normal and no hemorrhages or exudate could be made out in any part of the retina. Vision in the right eye was reduced to light perception in the lower nasal field, and counting fingers in the left eye (patient very drowsy). The detachments extended far forward and could be seen by oblique illumination.

The day following this examination there was no change, but upon the fourth day there was a noticeable decrease in size of the detachments and they had changed position in each eye, being now in the lower portion of the retina and becoming re-attached above. There was a steady improvement in the condition, that is a decrease in size of the detachments. On the seventh day the separation was very slight

in extent in the right eye, the nerve head now appeared oedematous and a small whitish patch of exudate was seen up and nasalward. The left, originally better eye, now showed more detachment than the right, but decreasing steadily. There was also a patch of exudate down and out. The arteries were paler than normal. On the ninth day no detachment could be made out in either eye but perivasculitis and irregularity of outline of the arteries was more marked. The patient was able to read coarse print. The fundus picture was practically as above at the time of discharge.

On April 7, 1922, one month after the beginning of the retinal separation the patient was examined at the office and the following conditions noted: The pupils were equal and media clear. The right nerve was blurred in outline up and in and one small hemorrhage was seen in the nerve fiber layer, down and out from the nerve. There was also a slight exudate still farther out. The veins were full and were indented by the arteries, which showed sclerosis and perivasculitis. The left nerve was blurred below and nasalward and there was a patch of exudate up and in from the nerve. Vision in the right was $\frac{2}{3}$ and in the left $\frac{1}{100}$ plus. The field of vision was of normal extent in the right eye and normal in all directions in the left except above, where it was constricted to about 10 degrees. No detachments could be made out through a widely dilated pupil.

No direct treatment was given to the eyes at any time, except the use of homatropine daily to keep the intraocular muscles at rest.

The case presented is interesting because of the rapid onset, its bilateral character, and its rarity. The patient did not develop eclampsia so that we must conclude, in view of the blood and urinary findings, that the detachments were only one expression of the marked oedema, due to impaired kidney function. As Clapp has pointed out, such detachments are undoubtedly more frequent than reports of the same and if all pregnant women with evidences of defective kidney elimination, especially with visual disturbances, were examined frequently, through dilated pupils, detachments, particularly when small and peripherally situated would be encountered. The serious general condition of the patients often causes the examination of the eyeground to be neglected, except in well organized hospital services.

Retinal detachment in pregnancy was first described by Albrecht von Graefe in 1855. In 1902 Heilbrun (3) collected 20 cases, including one observed by himself, while in 1921 Schiötz (42) found reports of 50 cases, including 7 of his own and the 6 cases of Clapp (38). Apparently my own case, detailed above makes a total of 51 examples of this interesting condition to date.

The detachments are seen usually in the later months of pregnancy and are rather more frequent in primiparæ, perhaps because of their less advanced age, and emmetropic eyes are quite as liable to suffer as the myopic. Most of the women develop eclampsia but not all, and the detachments are usually globular and situated in the lower part of the retina, but total separation has been noted. The very great majority of the cases are bilateral and re-attachment after the delivery of the child is the rule.

Cases in which the detachment occurs some weeks after delivery of the child, in women suffering from a severe chronic nephritis and who usually succumb within a few months, are not properly placed in this class of retinal detachments of pregnancy.

Foster Moore (39) reports 13 cases of retinal detachments in renal retinitis, 5 of them occurring in pregnant women; of these latter, 3 suffered from chronic nephritis before pregnancy began and died before full term and must therefore be considered as examples of detachment complicating chronic nephritis, the latter being aggravated by pregnancy. In these cases re-attachment of the retina did not occur.

Ingolf Schiötz (42) has made a most exhaustive and interesting study of this whole subject, the results of which are published in an article of 136 pages. He gives an historical review of the subject of eye findings during pregnancy, discusses the urinary and blood changes, and adds observations on cases of his own. The paper is divided into three parts, (1) the retinitis of pregnancy, (2) eye findings in eclamptic cases, (3) eclamptic amaurosis. His conclusions are based upon the study of the eyes of 6800 pregnant women, seen during five years. In this large series he found seven cases of detachment of the retina in eclamptic women.

Four of Schiötz's cases of detachment showed signs of renal

retinitis while in three of them retinitis was lacking, thus disproving the belief of Moore that the retinitis is an essential concomitant to the detachment. These three cases were eclamptic primiparæ who showed no nephritis preceding pregnancy and one must look, therefore, for the contact point between retinal detachment and nephritis in the pregnancy itself. In two of these patients the detachments were unilateral and have remained stationary in the years which have since passed. One must admit, of course, the remote possibility of the existence of the detachment previous to the pregnancy. The prognosis of retinal detachment, even without retinitis, is, therefore, not uniformly good.

In the 4 cases of Schiötz of detachment associated with retinitis the retina re-applied itself from four to six weeks. Improvement began immediately after the delivery of the child and re-attachment was complete within a few weeks post partum.

As to the immediate cause of the detachment, opinions differ. Moore feels strongly that the detachment is always associated with a retinitis and is due to the latter. In this view Schiötz does not concur. Moore reports on the examination of 91 soldiers suffering from an aggravated form of chronic nephritis without retinitis and none of whom developed a detachment, while on the other hand, of 13 cases of detachment all suffered from retinitis. He concludes that the subretinal exudate, liquid or solid, or partly both, is derived from the retina alone and in this Schiötz disagrees, believing that the choroid plays the essential rôle. Verderame (20) examined histologically the eyes of a patient who died from cerebral tumor some years after the occurrence of bilateral detachment during pregnancy. Her vision had recovered to $\frac{1}{2}$. He remarks upon the extreme sclerosis of the choroidal vessels and points out that the other changes were slight. He believes that the important changes are in the choroid and not in the retina. That the detachment is not merely a part of the general oedema is proved by a study of Schiötz's 7 cases, 2 of whom showed severe general oedema with puffiness of the face and oedema of the ankles, 3 showed slight puffiness of the face and oedema of the ankles, and in 2 no oedema was present. In my own case the oedema of the face, hands, and ankles was

severe. The real cause is probably a primary fluid collection beneath the retina, not necessarily a part of a general oedema, but produced by the same little understood factor in a tissue which is anatomically vulnerable to separation.

The prognosis as to vision is good but the great majority of the patients do not regain normal sight. This is due rather to the retinitis generally associated with the detachment and results from the destruction of retinal elements and not from retinal separation. Proof of this is seen in the fields of vision, which are usually contracted but in which the blind portion does not correspond to the previously detached part of the retina.

At least one case has been recorded in which a later pregnancy has supervened without a repetition of the detachment. In fact it is conceivable that the re-attached portion of the retina may be more firmly adherent than the normal retina, due to the organization of the subretinal fluid which is often rich in cells.

As to the treatment of the condition there seems to be no question but that the delivery of the child at the earliest moment is indicated. It is possible, as mentioned by Clapp, that withdrawal of the spinal fluid may be desirous.

We may therefore conclude that retinal detachment in the nephritis of pregnancy is usually but not always bilateral, occurs generally in association with signs of renal retinitis but at times with no evidence of the latter, tends to spontaneous re-attachment in the great majority of cases and this within from 2 days to 6 weeks after the delivery of the child.

I am indebted to Dr. Arthur H. Morse, Professor of Obstetrics and Gynecology, upon whose service the patient entered the hospital, for the opportunity to study this case.

BIBLIOGRAPHY.

(NOTE: Some of these references concern retinal detachment of nephritis in other conditions than pregnancy but seem of sufficient interest to include here.)

1. NORDENSEN. *Die Netzhautablösung.* Wiesbaden, 1887.
2. KUNZ. Dissertation, Marburg, 1897.

3. HEILBRUN. "Über Netzhautablösung bei Schwangerschaftsnephritis," *Berl. klin. W.*, 1902. S. 69 u. 103.
4. NETTLESHIP. *R. L. O. H. Reports*, vol. xvi. Also *Trans. Ophth. Soc.*, vol. xix, *R. L. O. H.*, vol. xv., p. 329.
5. SCHLESINGER. Quoted Parson's *Pathology*.
6. GALEZOWSKI. *Ibid.*
7. WILSON & HIRD. *Lancet*, July 17, 1909, p. 146.
8. HAHN & KNAGG. *Lancet*, May 18, 1901, p. 1391.
9. GOURFEIN-WELT. *Recueil des travaux X Congrès intern. d'opht.*, Lucerne, Sept., 1904, p. 33.
10. GOLDZIEHER. *Die ophth. Klinik*, Feb. 20, 1900.
11. ROEMER. *Textbook of Ophth.* (Foster's Translation.) 1913, p. 755.
12. WEST. Lettsomian Lectures, 1900.
13. ANDERSON. *Trans. Ophth. Soc.*, vol. viii., 1888, p. 141.
14. SINCLAIR. *Jour. Pathol. & Bact.*, June, 1901, p. 294.
15. UTHOFF. Heidelberg Congress, Sept., 1903, p. 4.
16. JONES. *Jour. A. M. A.*, Jan. 23, 1913, p. 334.
17. SAWYER. *Birmingham Med. Rev.*, 1903, p. 566.
18. JAMES. *Ophth. Review*, vol. xxxii., 1913, p. 164.
19. EASON. *Trans. Ophth. Soc.*, xxiv., 1904.
20. VERDERAME. "Über nichtalbuminurische und albuminurische Netzhautablösung und ihre Wiederanlegen bei Schwangeren." *Kl. M. f. A.*, Bd. 49, S. 452.
21. SCHWEIGGER. *ARCHIVES OF OPHTH.*, 1882, p. 456.
22. SYM. *Ophth. Record*, vol. xxxii., 1913, p. 293.
23. GREENWOOD. *Ophthalmology*, Jan., 1905, p. 8.
24. SOUTHEY. *Lancet*, Jan. 13, 1883, p. 47.
25. WADSWORTH. *Trans. Amer. Ophth. Soc.*, 1887.
26. FISHER. Proceedings R. S., for July 1915, p. 142.
27. SCHERENBERG. "Ein Fall von doppelseitiger Netzhautablösung mit Drucksteigerung bei Retinitis alb. gravid." *Kl. M. f. A.*, 1905, ii., S. 31.
28. ADAMÜK. *Westnik. Ophth.*, 1882, p. 456.
29. v. HIPPEL. *Ophth. Gesellschaft*, Heidelberg, 1908, p. 362.
30. HAGG. *Lancet*, June 12, 1875, p. 824.
31. COLLINS. *Trans. Ophth. Soc.*, vol. viii., p. 129.
32. DAVIDSON. *Ibid.*, vol. i., 1880, p. 57.
33. QUINLAN. *Ibid.*, vol. i., 1880, p. 58.
34. DICKINSON. *Diseases of the Kidney*, 1877, p. 546.
35. WEEKS. *Diseases of the Eye*, 1910, p. 482.
36. LANGDON. *Trans. Coll. of Physicians*, Phila., vol. xxxv., p. 429.
37. ROCHON-DUVIGNÉAUD. *Bull. et Mém. de la Soc. Franç. d'ophtal.*, 1912, p. 36.
38. CLAPP. *American Jour. of Ophthal.*, July, 1919.
39. MOORE, FOSTER, *R. L. O. H. Reports*, 1916, vol. xx., II.
40. HIPPEL u. ADAMÜK. *Vers. O. G. Heidelberg*, 1908, s. 362.
41. KNAPE, ERNST. *Finska Läkareselskapets*, 1910, Bd. 52, S. 533.
42. SCHIÖTZ. I. *Kl. M. f. A.*, 1919, Bd. 62, S. 234.

43. STOEWER. *Zeit. f. A.*, 1917, Bd. 36. S. 314.
44. UDDGREN, GERDA. *Oegonklinik*, 1889-1908. *Hygeia.*, 1908, S. 887.
45. DEL ZOPO & SOLI. *Ann. di Ottal.*, v. xxxiii., 1904.
46. COHEN, M. *Trans. N. Y. Acad. Med., Ophth. Sect.*, March, 1914.
47. CALHOUN, F. P. *Jour. A. M. A.*, Oct. 15, 1921.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by DRs. A. N. ALLING, New Haven; M. J. SCHOENBERG, New York; T. H. BUTLER, London; P. G. DOYNE, London; and K. WESSELY (*Archiv f. Augenheilkunde*), Würzburg.

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(Continued from March number.)

VI.—THE LIDS AND LACRIMAL ORGANS.

35. DIMITRY, T. J. Hereditary ptosis. *American Journal of Ophthalmology*, September, 1921.
36. GIFFORD, S. R. The aetiology of chronic meibomitis. *Ibid.*, August, 1921.
37. HECKEL, E. B. Blepharochalasis with ptosis. *Ibid.*, April, 1921.
38. ROESEN. Congenital ptosis. *Deutsche med. Wochenschr.*, 1920, p. 1044.
39. SCHMALFUSS. Mikulicz's disease and its treatment. *Fortschritte Med.*, 1920, p. 145.
40. SCHMID-HELLMUTH. Mikulicz's disease. *Folia hematol.*, xxv., p. 71.
41. STOCK. Dacryoadenitis, bloody tears, streptothrix in the canaliculi. *Klin. Monatsbl. f. Augenheilk.*, lxv., p. 416.
42. WICK. A rare tumor of the lid (fibro-chondro-epithelioma). *Ibid.*, lxv., p. 328.

DIMITRY (35, *Hereditary ptosis*) found in five generations of a family of thirty-eight, twenty-one showing congenital ptosis. He prefers the term of blepharophimosis as the palpebral fissure is shortened and the upper lids stretched so that from one third to one half of the cornea is covered. This condition of undeveloped palpebral fissure demands different treatment from ordinary ptosis and he performed a canthoplasty with tenotomy of the palpebral ligament. ALLING.

ROESEN (38, *Congenital ptosis*) obtained a good cosmetic result in a case of congenital ptosis by Motais's operation, in spite of the fact that the upper lid contained a fairly large scar, resulting from a former excision of a portion of the skin. Motais's operation can be employed only when the innervation of the eye muscles is intact.

HECKEL'S (37, *Blepharochalasis with ptosis*) case is unique in that it was monolateral with complete ptosis. The eyelid was raised by excising an elliptical piece of redundant skin.

ALLING.

GIFFORD (36, *Aetiology of chronic meibomitis*) found from cultures that the bacillus xerosis and the staphylococcus were usually present in normal cases as well as in chronic meibomitis being present probably at the roots of the lashes. The smears showed either negative results or a varied flora. ALLING.

WICK (42, *Rare tumor of the lid*) reports finding in a man 28 years old a tumor of the lid which was diagnosed under the microscope as a fibro-chondro-epithelioma. Below the left canthus was a roundish tumor, 1cm in diameter, attached by a broad base to the skin, into which it gradually blended, and with which it could be freely moved about. The middle portion was somewhat rough, the skin over it fibrinlike and easily removed so as to reveal beneath it a dense, white tissue. The microscopic findings were: Great cell proliferations in loose connective tissue, partly in branched cords of cells with formation of hollow spaces. The cells were for the most part epithelial, not bound together in large masses. Hence the diagnosis of epithelioma. Some of the appearances, such as absence of connection with the skin and the presence of red blood corpuscles in two hollow spaces, were suggestive of endothelioma, but opposing this diagnosis were the age of the patient and the fact that a clear transition from normal to pathologically changed endothelium could nowhere be demonstrated. Nothing was found characteristic of carcinoma. Wick considers that it was probably a mixed tumor.

SCHMALFUSS (39, *Mikulicz's disease*) reviews the literature concerning this disease, which he considers sui generis, particularly when only such cases are considered as present the symptoms enumerated by Mikulicz. Only twelve of the reported cases does he consider as positively belonging in this category, while ten others are admitted as very probably belonging. The characteristic features of the disease are its chronic course, the absence of pain in the affected organs and their unimpaired function. Histological examination confirms the condition mentioned by Mikulicz of small cell infiltration of the connective tissue and degenerative processes in the acini.

The presence of giant cells, mentioned by many authors, almost certainly indicates a special disease. The absence of general symptoms is noteworthy; the blood is always normal, there is never any fever. The aetiology of the disease, which gives the impression of a chronic infection, is unknown; he thinks it is almost certainly an ectogenous infection. The disease is met with in all ages of life, usually sporadically. The only remedies suggested are arsenic and the X-rays.

SCHMID-HELLMUTH (40, *Mikulicz's disease*) reports three cases of this disease, considering mainly the blood picture. He says that the lymphatic elements show distinct deviations. In Case 1 there was relative lymphocytosis and lymphatic polymorpha; in Case 2 a diminution of the lymphocytes due to the destruction of the lymphocyte building organs. Perhaps a lymphogranulomatosis was present, as indicated by the tumor of the spleen and the failure of arsenical therapy. Case 3 had pseudoleucæmia. Relative lymphocytosis was absent, while the polymorphous condition of the lymphocyte elements was marked. The glossitis and stomatitis present were probably caused by lymphatic proliferation.

STOCK (41, *Dacryoadenitis, bloody tears, streptothrix in the canaliculi*) describes five cases of dacryoadenitis which began suddenly with great swelling of the lacrimal glands and the formation of abscesses. The pus contained pneumococci and staphylococci. No such disease as mumps or influenza was present. In a sixth case there was a bilateral swelling of the lacrimal glands with fluctuation. Incision revealed a granulation tissue which, when inoculated into a rabbit's eye, induced the typical iritis of inoculated tuberculosis. Microscopical examination of the granulation tissue showed typical tuberculous changes. The gland on only one side was opened, that on the other side recovered without treatment. He believes that tuberculosis of the lacrimal glands is more common than is supposed, that it is of haemogenous origin, and that it may recover spontaneously without special treatment. Stock traced the bloody tears seen in a girl 12 years old, to a little loop of vessels which could easily be made to bleed. The patient with streptothrix had the characteristic swelling of the canaliculi and some purulent secretion. Dilatation and cleansing of the canaliculi resulted in a cure.

VII.—THE ORBITS AND ACCESSORY SINUSES.

43. CHANCE, B. Radium plugs for the dissolution of orbital gliomatous masses developing after excision of the globe. *American Journal of Ophthalmology*, September, 1921.
44. CREMER. A case of lymphangioma cysticum of the orbit. *Zeitschr. f. Augenheilk.*, xliv., p. 65.
45. DESAX. Plastic closure of fistulæ between the orbit and the accessory sinuses. *Archiv f. Augenheilk.*, lxxxvi., p. 306.
46. FINNOFF, W. C. Carcinoma of the orbit. *American Journal of Ophthalmology*, April, 1921.
47. MYGIND. Acute inflammations in the orbit originating from the accessory sinuses. *Klin. Monatsbl. f. Augenheilk.*, lxv., p. 429.
48. WEINGÄRTNER. Orbital abscess with panophthalmitis. *Deutsche med. Wochenschrift*, 1920, p. 936.
49. WHEELER, J. M. Restoration of obliterated eye socket. *American Journal of Ophthalmology*, July, 1921.
50. WICK. Bilateral phlegmon of the orbit and thrombosis of the cavernous sinus. *Klin. Monatsbl. f. Augenheilkunde*, lxv., p. 335.

CHANCE (43, **Radium plugs for the dissolution of orbital gliomatous masses developing after excision of the globe**) made use of a number of slender plugs or needles containing 10mg of radium which were left in the gliomatous masses filling the orbits. After an exposure of twenty hours there was severe reaction but the new growth gradually disappeared and the child regained its health. As only a few months have elapsed since the treatment, it is yet too soon to determine whether the cure is permanent.

ALLING.

FINNOFF (46, **Carcinoma of the orbit**) removed five hard encapsulated tumors from the orbit which proved to be scirrhous adeno-carcinomata. From the history one might conclude that the tumor was primary in the orbit, in which case it could be explained on the theory that, in the development of the lacrimal gland, a portion became separated as an embryonic nest in the orbit developing malignancy later. The author, however, is inclined to believe that the primary growth existed elsewhere in the body. The patient died of malignant tumors in different parts of the body about a year after operation. Only seventeen cases of carcinoma of the orbit without involvement of the globe, lacrimal gland, or skin have been reported.

ALLING.

CREMER (44, *Lymphangioma cysticum*) reports a case of cystic lymphangioma of the orbit, enclosed in a strong connective tissue capsule, met with in a child 11 years old. The tumor, which was said to have originated from a blow, had always been painless. There was marked exophthalmos, restriction of movement of the eyeball, and swelling of the lids. The skin of the lid was yellowish black, and fluctuation could be felt. Vision was good, the X-rays negative. The clinical diagnosis wavered between dermoid and lymphangioma. The tumor was shelled out uninjured. Healing followed smoothly. At the time of discharge the lid was still lax, the eyeball still somewhat protuberant outward and downwards, its mobility slight, especially toward the nose. The inner wall of the cyst had a distinct lining of endothelium, the connective tissue capsule was markedly infiltrated with small cells, and about the vessels were nests of lymphocytes, but nowhere typical lymph follicles. In the cyst wall were small hollow spaces lined with endothelium. There was much smooth muscle tissue. Dermoid was positively excluded. The marked infiltration of the cyst wall and the presence of clots of fibrin in the hollow spaces indicated lymphangioma rather than cavernoma. The development of the lymphangioma is ascribed to an embryonal disturbance of development.

DESAX (45, *Plastic closure of fistulæ between the orbit and the accessory sinuses*) describes three cases, all due to shot wounds. In Case 1 a cicatrix of the upper lid was adherent to the bone and the lateral portion of the lid hung like a flap in the much shrunken orbit. There was only a cleft-like small conjunctival sac, in the medial portion of which appeared a large defect leading into the nose. The upper lid was separated from the scar and undermined, the aperture into the nose was then closed by conjunctiva dissected from the lower lid. The other portions of the conjunctiva were removed that granulations might gradually fill the cavity of the wound. The lashes were extirpated and the lids sutured together. A tampon was placed in the nose. The fistula was closed in about a month. In the second case the left eyeball was absent, both lids were drawn back into the orbit by cicatrices. Laterally in the conjunctival sac was a large defect which passed over into a fistula leading into the nasal cavity. The entire conjunctival sac was excised,

the remains of lid were undermined so that they could be well united. The lids when sutured together were pressed into the orbit by a tampon. Sixteen days later the fistula was closed. In Case 3 the right eye was absent, the lower margin of the orbit was wanting, there were large defects in both upper and lower lids, a very flat conjunctival sac, and below a fistula leading into the maxillary sinus. The X-rays showed obscuration of the maxillary sinus. The maxillary sinus was found to be almost completely gone, its remains to contain thickened mucous membrane. The lids were undermined, sutured after removal of the conjunctival sac, and healing was complete in a month.

WHEELER (49, **Restoration of obliterated eye socket**) has had an extensive experience with this operation. He makes a mold of dental compound, which softens with heat, and fits about this a thin skin graft of epidermis only. He cuts it from the thigh with a large razor. An extensive bed for the graft is obtained by dissection close to the lids, even to thinning of the tarsus, and well back into the orbital tissue. He also increases the size of the orbit by free canthotomy. He has not found it necessary to stitch the graft to the form, if it is smeared with vaseline. The form is then forced into the cavity and a tight pressure bandage applied which should be left in place for a week. This method gives a permanent socket extending well beyond the canthi and of sufficient dimensions to hold an artificial eye.

ALLING.

MYGIND (47, **Acute inflammations in the orbit originating from the accessory sinuses**) reports twenty-five cases, in most of which the ethmoid was primarily affected. The most important symptom is the exophthalmos. The swelling of the upper lid is not as characteristic. The differential diagnosis between a collection of pus in the orbit and a disease of the accessory sinuses is often very difficult. Early operation is indicated in either case because of the danger of intracranial complications.

WEINGÄRTNER (48, **Orbital abscess with panophthalmitis**) reports an acute case of this nature. The X-ray showed obscuration of the frontal sinus; this was found unaffected at operation, the trouble being a deep abscess of the orbit.

WICK (50, **Bilateral phlegmon of the orbit and thrombosis of the cavernous sinus**) reports a case of this nature which developed from an unknown origin in a woman 28 years old. The orbits were exenterated at once, but death followed in 78 hours. The accessory sinuses were normal. The clinical diagnosis was confirmed by autopsy. All portions of the eye, and the cellular tissue of the orbit were densely infiltrated with round cells with staphylococci. Autopsy showed a great toxic poisoning of the body but did not reveal the cause.

VIII.—THE CONJUNCTIVA AND CORNEA.

51. BIRCH-HIRSCHFELD. Treatment of inflammatory diseases of the cornea, especially of *ulcus serpens*, with ultraviolet light. *Zeitschr. f. Augenheilkunde*, xliv.
52. BLASKOVICS. Tattooing of the cornea with candle soot. *Klin. Monatsbl. f. Augenheilkunde*, lxv., p. 78.
53. ENROTH. Parenchymatous keratitis and the constitution. *Ibid.*, lxv., p. 266.
54. FLECK, H. K. Disciform keratitis secondary to smallpox. *American Journal of Ophthalmology*, August, 1921.
55. JUNIUS. Modern views concerning herpes zoster. *Zeitschrift f. Augenheilkunde*, xliv., p. 74.
56. KUNZE. Anatomical examination of a case of parenchymatous keratitis due to hereditary syphilis. *Archiv f. Ophthalm.*, cii., p. 4.
57. LAUTERSTEIN. Hypopyon after luetin reaction in parenchymatous keratitis. *Ophthalmic Society in Vienna*, June 21, 1920.
58. MEESMANN. Pigmentation of the limbus corneæ in Addison's disease. *Klin. Monatsbl. f. Augenheilk.*, lxv., p. 316.
59. NOVAK. Symmetrical lipodermoids on both eyes. *Ophthalmic Society of Vienna*, June 21, 1920.
60. SIEGRIST. Typical *ulcus rodens corneæ* following a hordeolum cured by zinciontophoresis. *Klin. Monatsbl. f. Augenheilk.*, lxv., p. 107.
61. SNELL, A. C. Metastatic infiltration of cornea. *American Journal of Ophthalmology*, June, 1921.
62. STOCKER. The infectious nature of febrile herpes corneæ. *Klin. Monatsbl. f. Augenheilkunde*, lxv., p. 298.

The 10-year-old patient of NOVAK (59, **Symmetrical lipodermoids on both eyes**) presented numerous congenital developmental faults, such as excessive dolichocephalus, nævi with differently colored hair on the scalp, and a large superficial nævus verucosus pigmentosus on the left cheek. Both eyes protruded slightly. At the limbus on the temporal side in the right eye, on the nasal in the left, was a lipodermoid as large

as a pea, which extended into the cornea somewhat. Beneath the conjunctiva of both eyes were large, lobed, reddish yellow, soft tumor masses that extended temporally to the outer canthus and could be followed far back into the orbit. An opacity extended down from above quite a distance into the cornea. The eyeballs were plainly pressed somewhat downward and their motility upward was a little impaired. Both pupils were displaced upward, there was partial ectropion of the pigment layer, and in the fundus could be seen a coloboma of the choroid.

MEESMANN (58, *Pigmentation of the limbus corneæ in Addison's disease*) describes a case of Addison's disease in a woman 31 years old in which, in addition to the frequently described pigmentation of the conjunctiva, the cornea was involved at the limbus. With the naked eye could be seen on each side an almost perfect ring, uniformly brownish black in color, about 2mm broad, occupying the limbus and extending for about half its breadth over the cornea. A distinct radiating striation of the ring could be seen with a weak enlargement, while with a stronger enlargement and the slit lamp the pigmentation of the conjunctiva became resolved into distinct spots with indistinct margins. The surface of the epithelium appeared to be intact, the pigment confined to the conjunctiva in all its layers, leaving the episclera free. In well marked spots there appeared a many branched and anastomosing canal system, its margins sharply defined by pigment. The limbus ring corresponded essentially in its arrangement to the pigmentation of the conjunctiva.

ENROTH'S (53, *Parenchymatous keratitis and the constitution*) studies of fifteen cases of diffuse parenchymatous keratitis showed that congenital syphilis was unquestionably present in thirteen, and that this disease was excluded with certainty in one, with probability in another. Tuberculosis was probably present in three, possibly in four others. In ten disturbances of the internal secretions could be demonstrated as very probable, while the others presented symptoms which might be regarded as endocrine. Six of the ten had clinical symptoms of status thymicolymphaticus and gave a positive Abderhalden reaction with thymus. In all of these cases there were at the same time present disturbances of other internal secre-

tions, such as in the function of the thyroid in two cases, of the thyroid and the sexual glands in one, the thyroid and the suprarenal capsules in one, the sexual glands and the hypophysis in one, and the spleen in one. In part these disturbances were demonstrated clinically and serologically, in part only serologically. In two cases a positive Abderhalden reaction was obtained only with thyroid, in two only with sexual glands; these cases showed also clinical disturbances referable to the organs in question. All the patients presented degenerative stigmata, some a number of them.

Without going deeply into the literature KUNZE (56, *Anatomical examination of a case of parenchymatous keratitis due to hereditary syphilis*) compares his findings in a pair of eyes with parenchymatous keratitis taken from a 12-year-old girl who had hereditary syphilis, with those of former writers. The epithelium showed a disturbance in the form and arrangement of the cells, a progressive thinning and final perforation, and a round cell infiltration. Most former observers found accumulations of round cells and changes in the epithelium. Splitting up or destruction of Bowman's membrane at some places, and its replacement in places by cellular tissue with elongated cells and vessels and a round cell infiltration are like what has already been described. Corresponding to the altered places in Bowman's membrane the propria and the epithelium frequently present an infiltration of round cells and a new formation of vessels. The anterior and the posterior layer of the parenchyma are involved in the pathological process, and the third of the cornea next to the limbus is more affected than the central third. The round cell infiltration is the most marked change, newly formed vessels may or may not be present. Part of the vessels are large, enclosed in strong walls, or free from round cell infiltration, while others are without walls, simply lined with endothelium; such without lumen are rare and may perhaps be regarded as undergoing involution. The lumina of the vessels in the scleral band are open, so that here almost nothing of obliterating processes can be found. This condition controverts the theory formerly held that the parenchymatous process in the cornea is due to obliteration of the pericorneal vascular plexus. Descemet's membrane is split and broken up, as found by others; this he explains as due

to cicatricial change of the posterior surface of the cornea. Whether the folding of Descemet's membrane described also in other cases may not be at least partially an artificial product, remains an open question. The changes in the endothelium are only slight, but a cellular infiltration can be recognized in the angle of the anterior chamber; a giant cell formation which can be followed over several sections shows conditions quite analogous to those described by Elschnig. Hippel also has observed giant cells in the angle of the anterior chamber as well as in the propria and Descemet's membrane, and Stähli has described a giant cell formation in the sparsely vascularized tissue of the angle of the anterior chamber. As typical as the infiltration of lymphocytes in the iris and ciliary body are many chorioretinitic foci of lymphocytes and epithelioid cells which show a tubercyloid construction quite similar to that portrayed by v. Hippel and Iggersheimer. Part of the manifold other changes in the choroid and retina are old cicatricial processes, part are more fresh. A search for spirochætæ in an excised piece of the cornea, stained by Levaditi's method, failed.

Hypopyon followed a luetin reaction in a child 4½ years old with parenchymatous keratitis, according to LAUTERSTEIN (57, **Hypopyon after luetin reaction in parenchymatous keratitis**). A causal connection is assumed. Treatment of parenchymatous keratitis with luetin proved a failure in Meller's clinic, but for diagnostic purposes the luetin reaction is very valuable. Out of nine cases it proved positive in eight and uncertain in one. Its employment is recommended in all cases, as it may be positive even when the Wassermann is negative.

FLECK (54, **Disciform keratitis secondary to smallpox**) observed a case of disciform keratitis which followed the removal of a foreign body in a patient who was in the first stage of smallpox. It is probable that the abrasion was infected from pustules which formed on the conjunctiva.

ALLING.

After thoroughly cleansing the eye of a patient suffering from febrile herpes corneæ, as well as the eye of a rabbit about to be inoculated, STOCKER (62, **Infectious nature of febrile herpes corneæ**) took some material from the diseased human

cornea with a sterile cataract knife and made with the same knife laden with the material for inoculation two or three parallel incisions into the cornea of the rabbit and rubbed in the material with the flat of the blade. The result was a keratitis in the rabbit very similar to that in the human eye. This experiment was repeated with material from five different patients with the same result each time. Control experiments showed that the result was not due simply to the traumatism and cocainization; that it was not due to the foreign albumin of the inoculated human corneal epithelium, and that the cause of the corneal disease in the rabbit was not a virus contained in any ulcer of the cornea, or one not specific for febrile herpes cornea ϵ . Another evidence of the specificity of the inoculated keratitis is that the typical disease could be transferred from the cornea of one rabbit to that of another, and from the second to a third. Simple rubbing of the inoculation material into the conjunctival sac, without incising the cornea, suffices to convey the herpes, but then the time of incubation is several days longer. The disease is best treated with such antiseptics as tincture of iodine and zinciontophoresis.

JUNIUS (55, *Modern views concerning herpes zoster*) makes the following points: 1. On the basis of the classification now accepted by neurologists herpes zoster ophthalmicus belongs for the most part in the group of secondary zosters. The causes of the primary disease are not always the same. The fundamental disease itself may already have been completely cured, and only a predisposition to nerve disturbance be left. Recurrence of the disease after a long interval has been observed. 2. Although a traumatic origin of herpes zoster ophthalmicus has not yet been established scientifically, sometimes in practice a connection between corneal traumatism and herpes cornea ϵ must be regarded as not impossible. 3. Possibly there is a herpes zoster ophthalmicus which is caused not through neuritis or disease of the nerve ganglia, but through a disturbance in the higher sensory centers of the trigeminus in the medulla oblongata. 4. Zosters occur on the eye with such rare complications as exophthalmos, or eruptions of blebs on the sclera, described as zoster of the ciliary nerves. 5. The connection of herpes zoster ophthalmicus with such other affections as keratitis neuroparalytica and ulcus cornea ϵ rodens

receives no further elucidation. Whether keratitis disciformis and other neuropathic diseases of the cornea have such connection should be investigated. 6. The essential factor in all these affections is a reduced vitality of the cornea. Necrosis is anatomically demonstrated in *ulcus rodens*, the same is true of *zoster uveæ*. 7. As regards treatment, irritant remedies are certainly not always ineffective, but their healing power can rest only on an alterative action. Caustics and cauterization are to be avoided in such high grade nutritive disturbances as are present in *ulcus rodens* *corneæ*.

SIEGRIST (60, *Typical ulcus rodens corneæ following a hordeolum cured by zinciontophoresis*) reports a case in which a single application of zinciontophoresis proved efficient after all other therapeutic measures had failed. He used a solution of zinc sulphate and a current of two milliamperes for 2 minutes.

SNELL (61, *Metastatic infiltration of cornea*) observed a man who had been severely burned over his entire body and developed on the ninth day a ring ulcer of the left eye which completely encircled the cornea and was speedily followed by panophthalmitis. The right cornea soon began to show signs of breaking down and the ulceration spread about one third the way about the circumference. After the rupture of Desemet's membrane the process made no further progress. The right eye recovered with fair vision. He regards the affection of the eyes as metastatic since the patient was toxic from infection from the numerous burns which were discharging pus.

ALLING.

BIRCH-HIRSCHFELD (51, *Treatment of inflammatory diseases of the cornea, especially ulcus serpens, with ultraviolet light*) confirms the observations of Hertel that ultraviolet light is a good means for the treatment of serpiginous ulcer and other inflammatory diseases of the cornea. He uses a small electric light with a quartz lens of 20 dioptries and a uviol glass in front of it. With another quartz lens, held between the thumb and forefinger, he focusses the rays upon the margins of the ulcer. The light used dazzles but little and induces no pain or feeling of heat after prolonged exposure, because most of the dazzling rays are disposed of by the uviol glass. A total of 43 pneumococcal ulcers were thus treated in a year and a half. In 33, which were healed by the irradiation alone, the

functional results were very good. The number of times irradiation was necessary varied. The individual irradiations were from 1 to 5 minutes, the average total time of irradiation was 39 minutes, the average duration of treatment was 12 days. The shortest time needed for a perfect result was a total of 8 or 9 minutes of irradiation, the longest 110 minutes in the course of 27 days. The determination of the dose for the individual case must be learned through practice. One may begin with sittings of five minutes each twice a day, and, after cleaning of the progressive margin, reduce the dose to a daily sitting of five minutes. If the epithelium has been regenerated, as after abrasion in cases of superficial keratitis, so that staining with fluorescin is no longer possible, the length of the irradiation must be increased, but not to the point of a harmful dose.

BLASKOVICS (52, *Tattooing of the cornea with candle soot*) shaves off the epithelium of the area to be tattooed and then scarifies the tissue with the knife held obliquely so that several layers of tissue lie one above another. The oblique position of the knife permits deep incisions without danger of perforation. It is important that a chemically indifferent and sterile coloring matter be used, and this he obtains in the soot from a candle. This he obtains by holding a perfectly clean slide over an ordinary candle and allowing it to blacken without letting the glass touch the wick. After the tattooing has been done he applies a dry dressing and bandage. There is almost no reaction. In ten or twelve cases treated in this way a bandage was necessary for only two or three days at most. In all cases the tattooed spot on the cornea was made intensely black at one sitting, and no infection was observed. A histological examination of a tattooed cornea which was accidentally made possible a few weeks after the tattooing had been done, showed that there had been a total absence of reaction to the operation. Beneath the epithelium were scattered grains of soot, while in the cicatricial tissue they were gathered together in masses. There was no cellular infiltration worth mention.

IX.—THE PUPILS.

63. FRIEDENTHAL. A case of perverse convergence reaction of the left pupil. *Deutsche med. Wochenschrift*, 1920, p. 929.

64. JUNIUS. Can influenza cause reflex immobility of the pupils? *Zeitschrift f. Augenheilkunde.*, xliv, 1920.
65. LÖWENSTEIN. Contribution to the study of katatonic pupillary changes. *Monatschrift f. Psych. u Neurol.*, 1920, xlvii., p. 194.
66. WILSON, S. A. KINNER. The Argyll-Robertson pupil. *Journal of Neurology and Psychopathology*, May, 1921.

FRIEDENTHAL (63, **Perverse convergence reaction**) reports a case of this nature met with in a syphilitic patient. Visual trouble had been corrected by glasses. The visual field and the motility of the eyeballs were normal. The right pupil was larger than the left; neither reacted to light. The right pupil contracted slowly in convergence, while the left dilated after a transient normal contraction. The fundus was normal. Neurological examination revealed nothing in particular aside from a weakening of the patellar reflex. Wassermann positive. The monilateral appearance of the perverse convergence reaction seems noteworthy.

WILSON (66, **The Argyll-Robertson pupil**) says that the condition of the pupil which constitutes the true Argyll-Robertson pupil is one in which there is an absence of the direct reflex to light—the consensual reflex being either present or absent—with preservation of the pupillary reaction on convergence-accommodation.

Myosis is not necessarily associated with the reflex and irregularity or inequality of the pupils is merely incidental.

The Argyll-Robertson sign is so commonly associated with neurosyphilis that the fact, that conditions definitely non-syphilitic can produce the condition, is often overlooked.

In this paper Wilson quotes cases of different conditions in which the sign was present and endeavors to produce anatomical evidence for a nervous mechanism directly associated with the sign.

Regarding the different conditions in which the Argyll-Robertson sign may be present; it has been found in epidemic encephalitis, in disseminated sclerosis, in cases of cerebral tumor in the vicinity of the third ventricle aqueduct or superior corpora quadrigemina in these cases together with the Argyll-Robertson sign there was paralysis of conjugate upward movement—in syringomyelia, in chronic alcoholism, and in trauma either to the eye or brain.

Wilson asserts that the sign can remain as a "scar" long after the active mischief has ceased and in consequence its prognostic value is of no great account.

It must be admitted that there is a physiological differentiation for reflex impulses as opposed to visual impulses. This differentiation has been substantiated: (1) by the presence of thick and thin fibers in the optic nerve; (2) by the presence of single and multiple combinations in the retina of ganglion cells with bipolar cells and rods and cones; also the relation between visual loss and reflex loss is not constant.

Wilson favors the view that the superior colliculus is an important station in the reflex arc, notwithstanding experiments in which this region has been destroyed without interference with the light reflex, as in these experiments it was doubtful if complete destruction had been effected.

He traces the light reflex fibers, after a partial decussation in the chiasma, to the superior colliculus via the superior brachium. Here they end and the reflex arc is continued on by the colliculo-nuclear tract, which passes around the wall of the aqueduct and which partially decussates, to the region of the oculomotor nuclei. These fibers may either end in the anterior end of the oculomotor nucleus or passing by, without forming connections, join the third nerve root and so on to the ciliary ganglion as preganglionic fibers.

Wilson does not credit the Edinger-Westphal nucleus as the iris-constricting center because this nucleus is not recognizable until the seventh month of foetal life whereas it has been shown that the pupil reacts to light by the end of the fifth month and further in some cases of fixity of the pupil to light no pathological changes have been found in the nucleus.

Regarding the path for convergence and accommodation; this is an associated movement and as such must be represented in the cortex, the details of the act being coördinated at the nuclear level.

Wilson favors a situation at the junction of the second frontal and precentral gyri, near to the known center for conjugate lateral movements, and traces the efferent connections with the oculomotor nuclei via the genu of the internal capsule to the crus cerebri whence the nuclear fibers pass

dorsally by the pes lemnisci profundus through the fillet to the nuclei of the ocular muscles.

Tumors in the neighborhood of the superior colliculus produce the Argyll-Robertson pupil and it is probable that a lesion in this situation is the commonest cause for the Argyll-Robertson sign, excepting those cases due to traumatism where the lesion is almost certainly nearer to the eyeball along the afferent tract.

The lesion in the Argyll-Robertson pupil is on the afferent side of the light reflex arc and the syphilitic toxin has a particular affinity for afferent systems and afferent terminal arborizations. To explain the great frequency of the Argyll-Robertson sign in neuro-syphilis, Wilson suggests that toxins from the infected cerebrospinal fluid spread through the subependymal tissues surrounding the aqueduct and attack the colliculo-nuclear fibers in this situation.

Regarding the frequent associated myosis; statistics show that this is present in 30 per cent. of cases of Argyll-Robertson pupil. Dilatation of the pupil can occur when the usual dilator tract is out of order. This is explained in the following way. There is a cortical center which has an inhibitory effect upon the tone of the constrictor center in the oculomotor group. It is probable that the fibers from this inhibitory center pass by peri-aqueductal lines to the oculomotor nuclei and consequently would be affected by the toxin which is affecting the afferent fibers of the pupil reflex arc. The consequent result being myosis owing to the unrestrained action of the constrictor center. This theory is supported by the fact that the Argyll-Robertson pupil does not dilate to emotional stimuli.

P. G. DOYNE.

JUNIUS (64, *Can influenza cause reflex immobility of the pupils?*) reports a case of reflex immobility of the pupils, slight anisocoria, slight weakness of the accommodation, and distinct paleness of the papillæ which could not be pronounced pathological from the fundus findings and the visual field. With plus glasses the man, 25 years old, had good vision for distance and near. The troubles of which he complained, dazzling and poor near vision without glasses, were attributed to a past attack of influenza. He denied having had syphilis and there were no signs of this disease except a positive Wassermann.

The question arises whether the influenza gave origin to the immobility of the pupils, although syphilis seems to be the more probable cause.

The fact that every psychic process is accompanied by changes in the size of the pupil in healthy men escapes general recognition at the present time, but in the healthy it is not always macroscopically perceptible. It is otherwise with those suffering from nervous troubles. LÖWENSTEIN (65, **Katatonic pupillary changes**) presents the following conclusions: 1. The absence of the restlessness of the pupils and the mydriatic katatonic immobility of the pupils have their cause in the same psychic change. 2. Conditions are produced by this change which induce varying degrees of inhibition of the reflex of the pupils to light. 3. Changes in the pupillary diameter and in the conditions of tension of the musculature of the body are not caused by each other, but by motor impressions of the same conditions of consciousness immediately caused by central changes.

X.—THE UVEAL TRACT AND SYMPATHETIC OPHTHALMIA.

67. GILBERT. Circle of nodules of the ciliary body in erythema nodosum. *Archiv f. Augenheilkunde*, lxxxvi., p. 50.
68. KADLETZ. Deposits of lime in the ciliary processes. *Zeitschrift f. Augenheilkunde*, 1920, xliv., p. 219.
69. KADLETZ. Detachment of the retina with sarcoma of the choroid. *Ibid.*, xliv., p. 219.
70. LAUBER. Unexplained tumor of the choroid. *Klin. Monatsbl. f. Augenheilkunde*, lxv., p. 423.
71. MELLER. Anatomical conditions found in both eyes in a case of sympathetic ophthalmia. *Archiv f. Ophthalmologie*, cii., p. 122.

GILBERT (67, **Circle of nodules of the ciliary body in erythema nodosum**) describes a case in which a ring of reddish gray nodules of varying breadth and arising from the ciliary body were almost everywhere visible in the anterior chamber. Opacities were present in the vitreous and the region of the ciliary body was sensitive to pressure, especially below. A week later the nodules underwent involution. These nodules were similar to the changes in the skin. There were no superficial vessels. There were no grounds for suspecting tuberculosis. The circular arrangement of nodules or tumors of the

ciliary body is rare; usually they occupy only a small part of the circumference.

KADLETZ (68, Deposits of lime in the ciliary processes) describes five cases in which such deposits were found. The diseases in which they occurred were one case of endophthalmitis after *ulcus serpens*, one of commencing atrophy of the globe after cataract extraction, one of necrotic sarcoma of the choroid, and two of sarcoma of another kind. The ciliary processes were in part normal, in part undergoing hyaline degeneration. The lime was found in little lumps, sharply defined and confined to the walls of the blood vessels; in one case it was deposited over the entire area of the processes with sharply defined margins. All of the patients were over 57 years old, so the writer considers this to be a senile phenomenon.

KADLETZ (69, Detachment of the retina with sarcoma of the choroid) reports a case of sarcoma of the choroid in which the retina was not detached. The tumor was a non-pigmented, fascicular sarcoma as large as a small pea situated at the upper margin of the papilla, where the intimate attachment of the retina to the optic nerve prevented detachment of the former. The tumor projected 4.3 mm into the vitreous and was covered by retina, adherent to it. The vitreous membrane of the choroid was broken through. The retina was split into two layers, perhaps because the pressure of the growing tumor was not exerted to the same degree upon the neuro-epithelial layer as upon the layer of nerve fibers.

LAUBER (70, Unexplained tumor of the choroid) observed in a woman 65 years old a protrusion 13 diopters high and 5 pupillary diameters in diameter two pupillary diameters below the optic nerve. Its margin was overhanging and in places it was covered by hemorrhages. Transillumination showed no such shadows as are produced by pigmented tumors. He believes it either a gumma or a tuberculous focus without pigment.

MELLER (71, Anatomical conditions found in both eyes in a case of sympathetic ophthalmia) reports a case in which a perforating wound of the cornea with prolapse of the iris was followed by increase of tension and ciliary and intercalary staphylomata. The eye was removed at the end of ten months.

Twenty days later a sympathetic inflammation appeared in the other eye and ran a rather mild course. Three months after its outbreak the patient died and the eyes were removed for examination. In the injured eye were unmistakable signs of a sympathy exciting inflammation, especially in the iris. The choroid also contained little foci of lymphocytes which were plainly fresh. The changes in the ciliary body were not specific. Perhaps the specific inflammation had started shortly before the enucleation of the eye. In the second eye the changes were less far advanced, in spite of the three months' duration. No inflammatory changes were visible outside of the eye. Perhaps the foci of lymphocytes correspond to the entrance of active agents, while the subsequent appearances with epithelioid and giant cells seem to be a consequence of the overcoming of the germs by the protective force of the organism, so that they may be connected with the cessation of the clinical symptoms.

(To be continued)

BOOK REVIEWS

VIII.—**Medical Ophthalmology.** By R. FOSTER MOORE, Assistant Ophthalmic Surgeon, St. Bartholomew's Hospital, Suregon Moorfields Eye Hospital. 300 pages, 80 illustrations. P. Blakiston Son & Co., Philadelphia, 1922. Price \$3.50.

The author, through his interest in this particular field and his opportunities in the medical wards of St. Bartholomew's Hospital, has been able to make many valuable investigations, which in part have appeared before and now are collected in a single volume, together with a review of the subject obtained principally from English and American writers. The changes are considered under the heads of separate diseases; a strict classification is not, however, carried out. While this may add to the readability of the book, omissions have occurred of conditions which seem important to the reviewer, and an uneven treatment of the subject has resulted.

Chapter I contains a description of certain conditions which the author prefers to consider out of their regular order, such as the cortical representation of vision, papilœdema retinal hemorrhages, etc. The chapters on arteriosclerosis and renal disease deserve particular mention and praise. The illustrations, all in black and white, are excellent. An author's index and a general index are added.

A. K.

IX.—**Diseases of the Eye.** By C. H. MAY. 10th edition, 440 pages, with many illustrations. New York, W. Wood & Co., 1922. Price \$3.50 net.

Dr. May's well-known text book has received a thorough revision for this new edition. The subject-matter is brought up to date without increasing the size of the volume. It should continue to enjoy the popularity it justly deserves.

A. K.

X.—**Die Krankheiten Des Auges im Zusammenhang mit der inneren Medizin.** Medical Ophthalmology by PROFESSOR L. HEINE, Director of the Eye-Clinic in Kiel. 540 pages, 219 illustrations (many in colors). Berlin, J. Springer, 1921.

Professor Heine, after a long apprenticeship under Uhthoff, has continued his investigations on the relation of eye diseases to general medicine in his twelve years at Kiel, and the result of these many years now appears in book form.

The subject is divided into two parts. In the first the eye symptoms occurring in general diseases are taken up as they appear on objective and subjective examinations, together with directions on how the examinations are made. In the second part the general diseases are taken in turn and in groups, and their characteristic eye symptoms are explained. The possible repetition in the two parts is only of advantage, and many points are thereby made more clear.

A remarkable feature of the book are the excellent illustrations; many of these are in colors, and some of the fundus pictures are given in both the usual light and in the red-free light.

The book contains an enormous amount of valuable information, with many original view points which are of interest without necessarily being convincing.

A. K.

XI.—**Scalae Typographicae.** By Dr. R. BIRKHAEUSER. 2d edition. Basel, E. Birkhaeuser & Co., 1922, franc 10 (Swiss).

These test-types for reading distance are undoubtedly the most exact and the best printed test-types in existence. They contain German, Italian, French and English text, and one page of numbers. They are noteworthy for the clear type, the dull, thick paper, and the convenient book form.

A. K.

Erratum. The illustrations on page 205 (May number) in "Trend in Glaucoma Operations" by Col. H. Herbert are wrongly placed and numbered. They should be placed upside down so that the conjunctival side is up, and fig. 2 applies to the earlier condition and No. 1 to the later.

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ILLUSTRATING DR. WALTER R. PARKER'S ARTICLE ON "DOUBLE
LUXATION OF THE EYEBALLS IN A CASE OF
EXOPHTHALMIC GOITER."

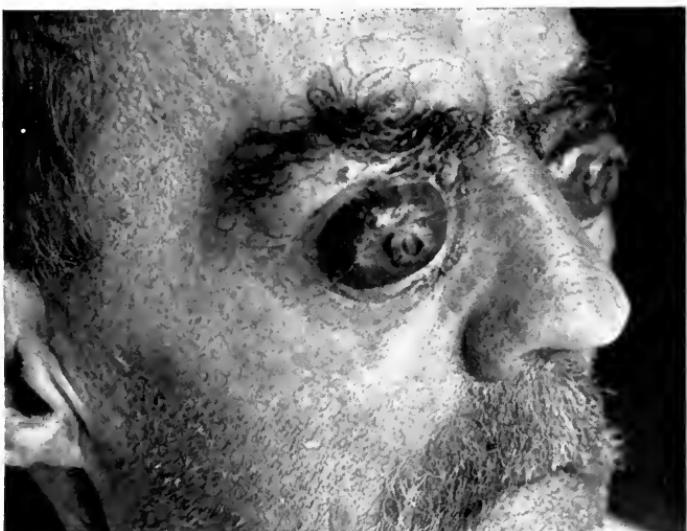


FIG. 1.

Photograph of patient as he appeared on admission to
the hospital.

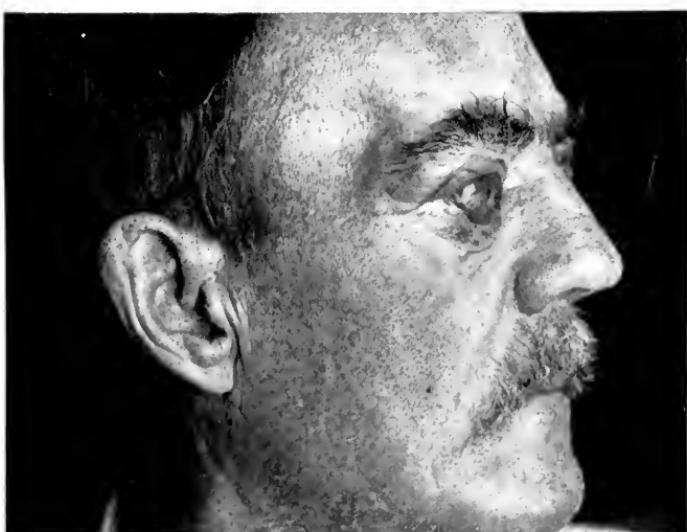
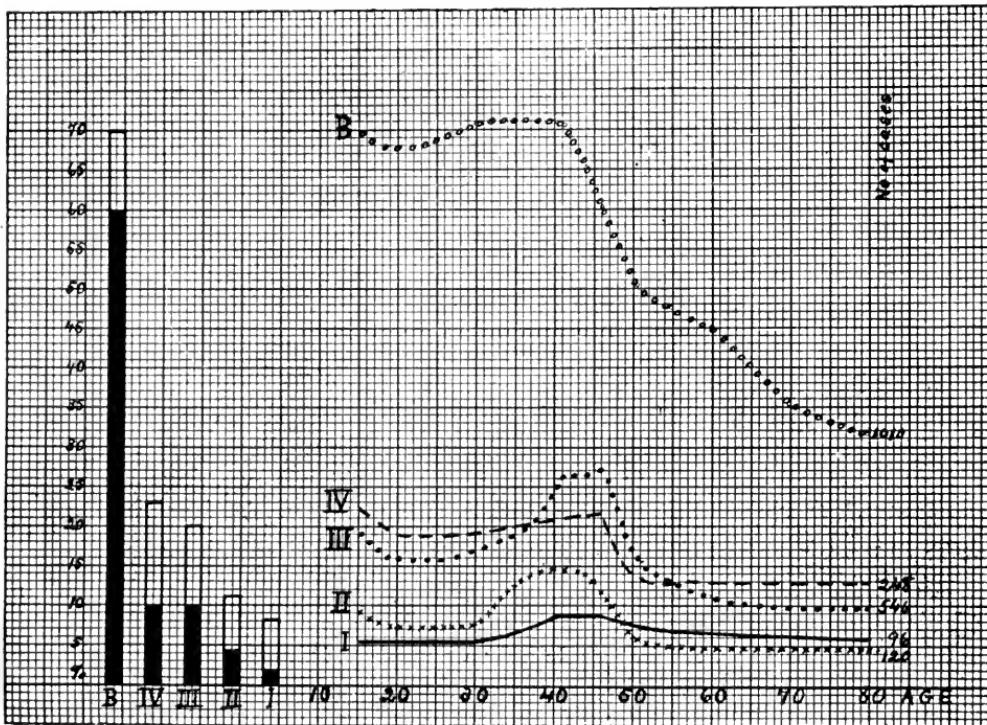


FIG. 2.

Photograph of patient as he appeared two and one half
months after admission to the hospital.

ILLUSTRATING DR. ALBERT C. SNELL'S ARTICLE ON "THE RELATION OF HEADACHE TO FUNCTIONAL MONOCULARITY."



B—binocular cases; I, II, III, IV—groups.

Solid column—percentage habitual headache cases.

Hollow column—percentage occasional headache cases.

Entire column—percentage for all headaches for each group.

Horizontal lines—percentage headache for age period for groups B and I, III, and IV.

ILLUSTRATING DR. FREDERICK TOOKE'S ARTICLE ON "SOME FEATURES
IN THE TECHNIQUE OF TREPHINING THE CORNEA FOR
THE RELIEF OF GLAUCOMA."

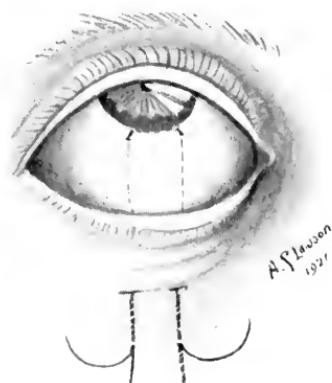


FIG. 1.

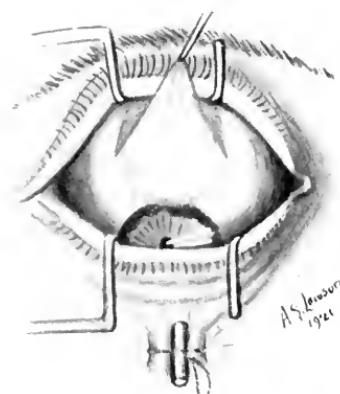


FIG. 2.

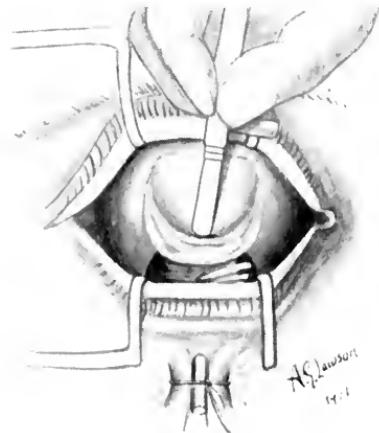


FIG. 3.

ILLUSTRATING DR. FREDERICK TOOKE'S ARTICLE ON "SOME FEATURES
IN THE TECHNIQUE OF TREPHINING THE CORNEA FOR
THE RELIEF OF GLAUCOMA."

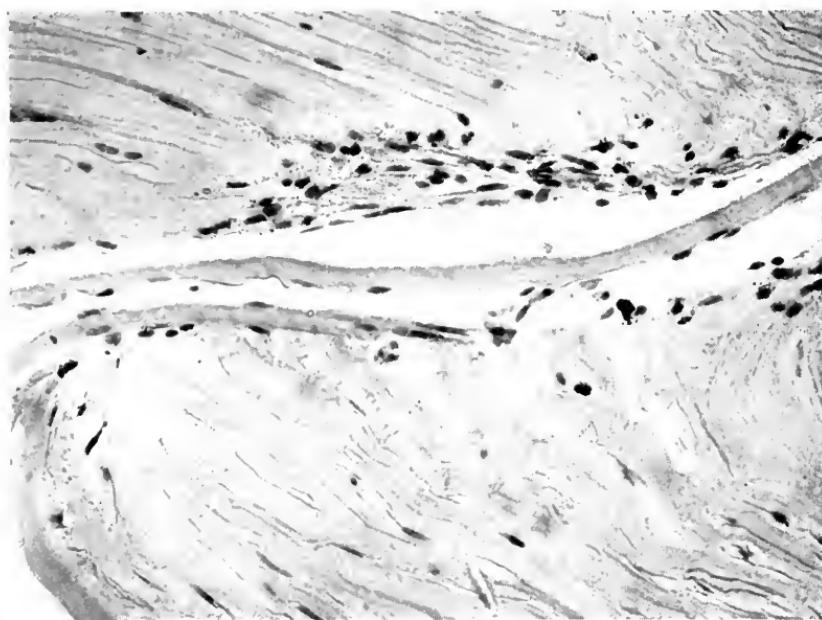


FIG. 4.

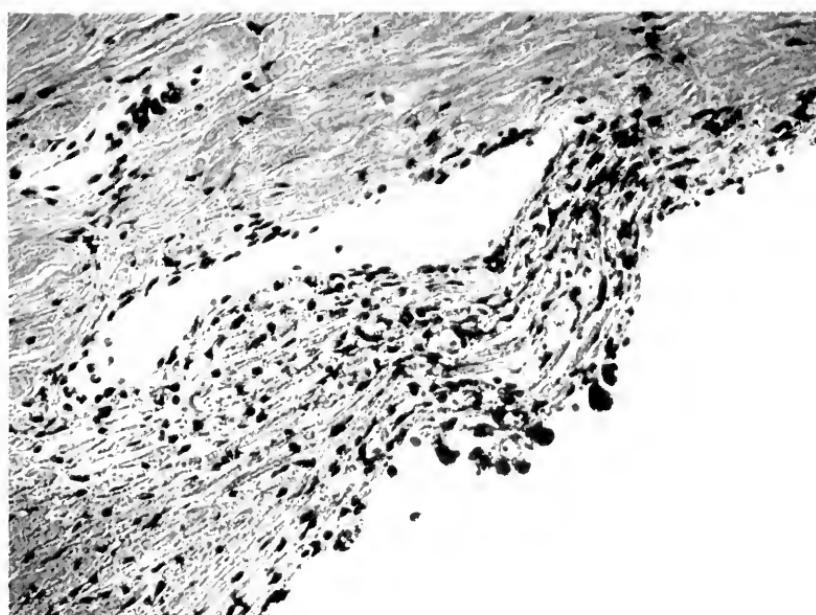


FIG. 5.

ILLUSTRATING DR. FREDERICK TOOKE'S ARTICLE ON "SOME FEATURES
IN THE TECHNIQUE OF TREPHINING THE CORNEA FOR
THE RELIEF OF GLAUCOMA."



FIG. 6.

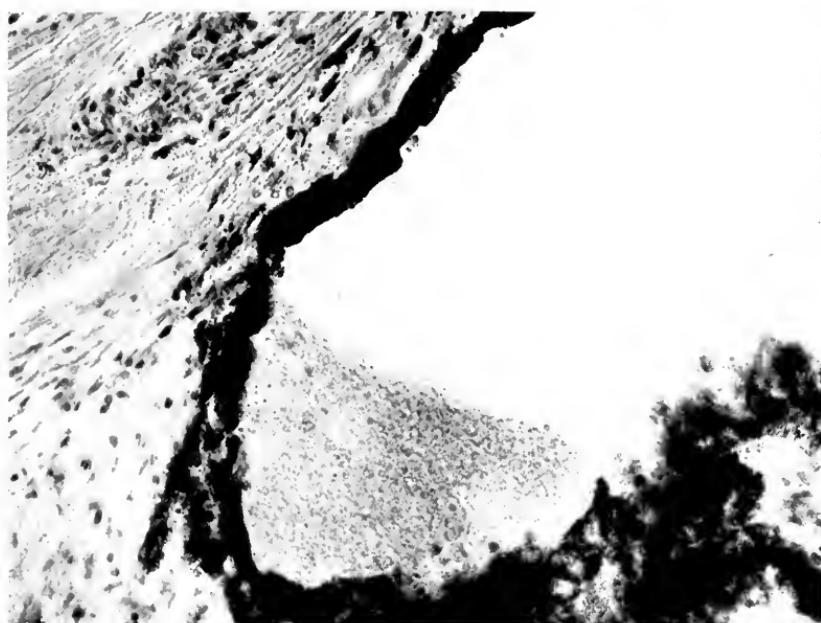


FIG. 7.

ILLUSTRATING DR. OTTO BARKAN'S ARTICLE ON "DIFFERENTIAL PUPILLOSCOPY."

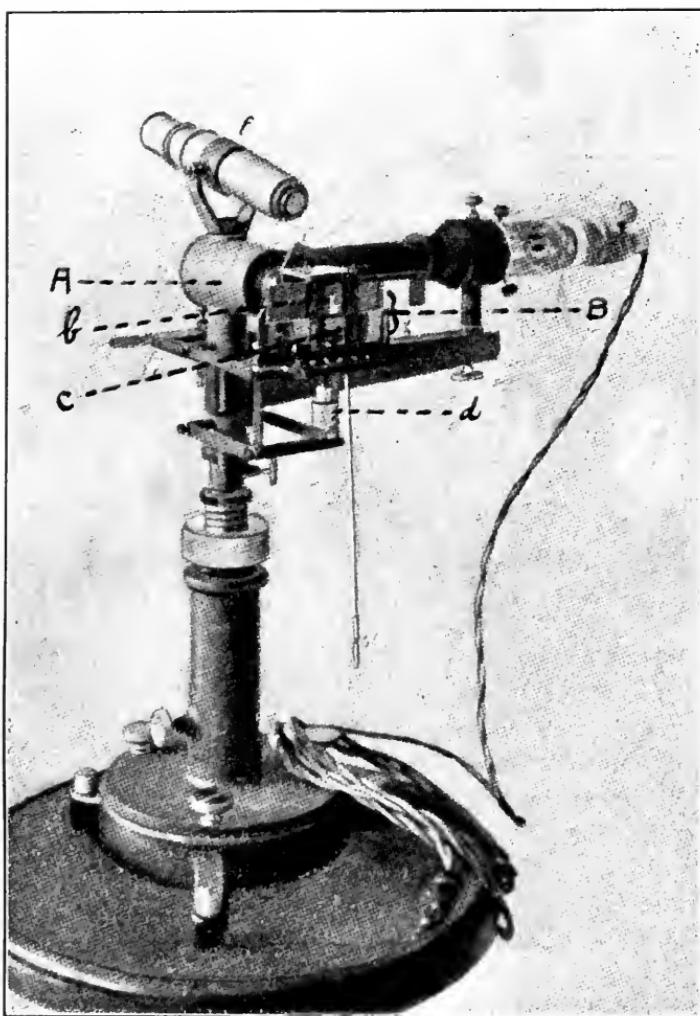


FIG. 1.

ILLUSTRATING DR. W. W. WRIGHT'S ARTICLE ON "THE USE OF LIVING SUTURE IN THE TREATMENT OF PTOSIS."

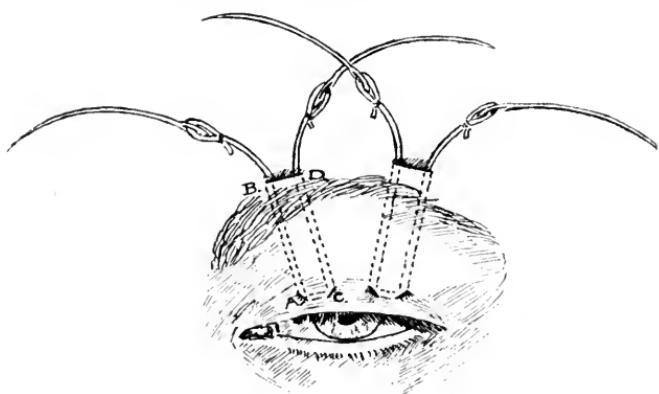


FIG. 1.

Modification of Pagenstecher's Operation Using Buried Sutures of Fascia Lata.

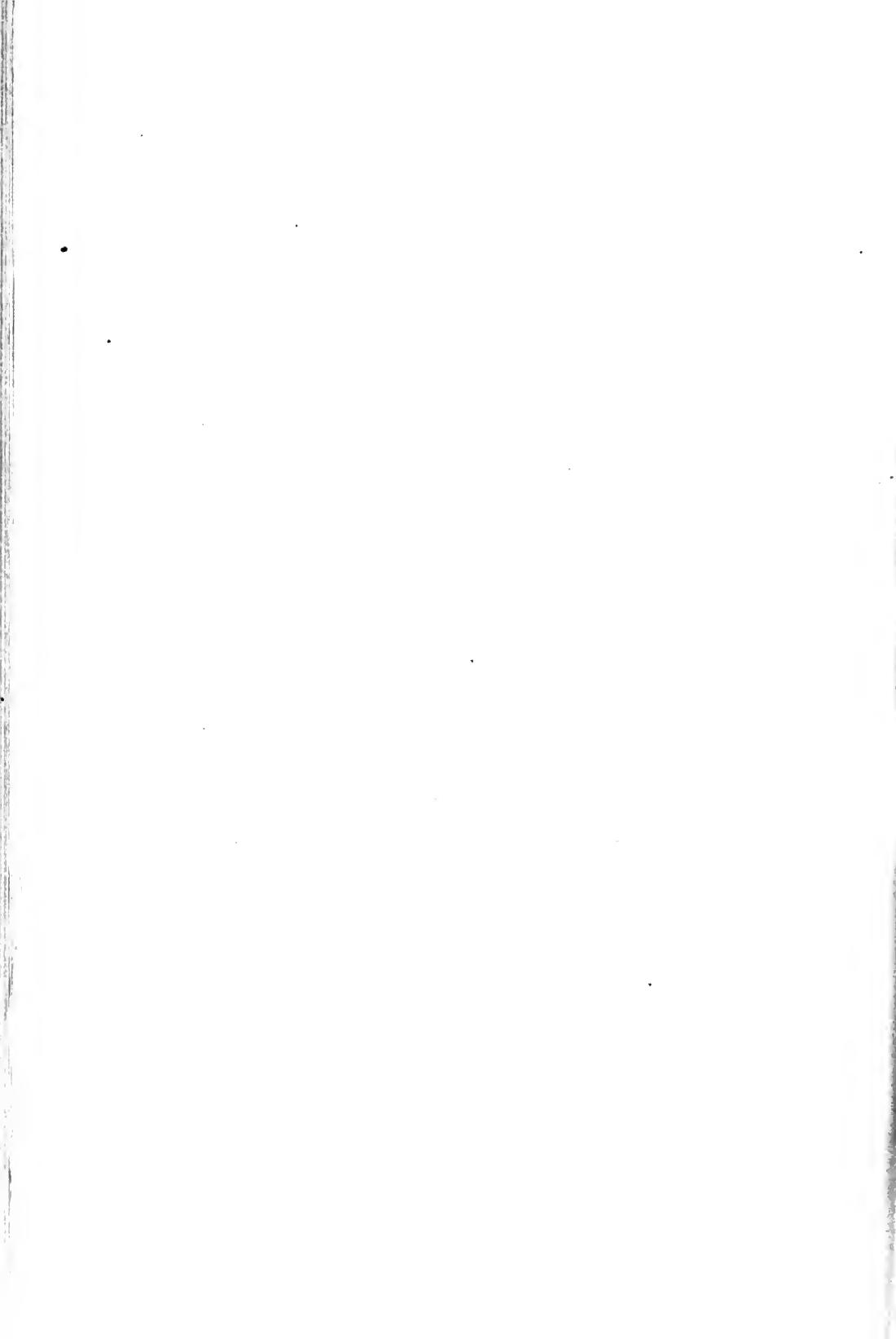


FIG. 2.



FIG. 3.

Result Thirteen Months after Operation for Left Congenital Ptosis. The Two Pictures Show the Considerable Degree of Motility Obtained.



ILLUSTRATING DR. F. H. VERHOEFF'S ARTICLE ON "PRIMARY INTRANEURAL TUMORS (GLIOMAS) OF THE OPTIC NERVE."



FIG. 1 (Case 1).—Glioma of Optic Nerve. Gross Specimen.



FIG. 2 (Case 2).—Glioma of Optic Nerve Showing Cystic and Gliomatous Involvement of the Optic Disk with Pre-papillary Cyst. The Retinal Separation is Artefact. About $\times 28$.



FIG. 3 (Case 3).—Glioma of Optic Nerve. Gross Specimen.

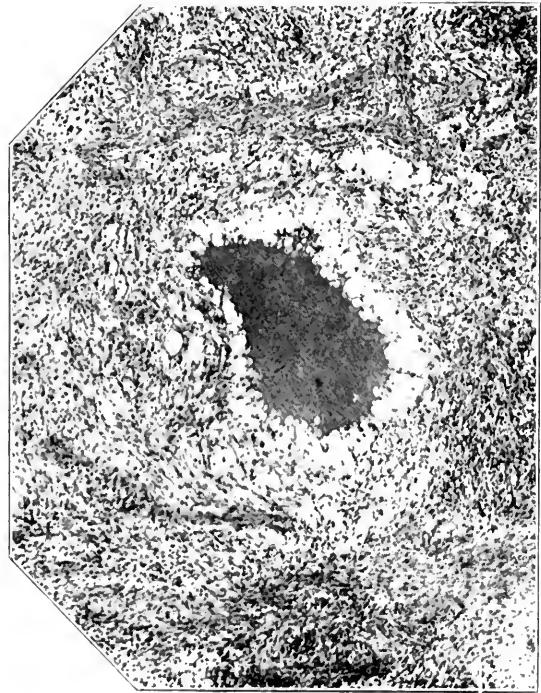
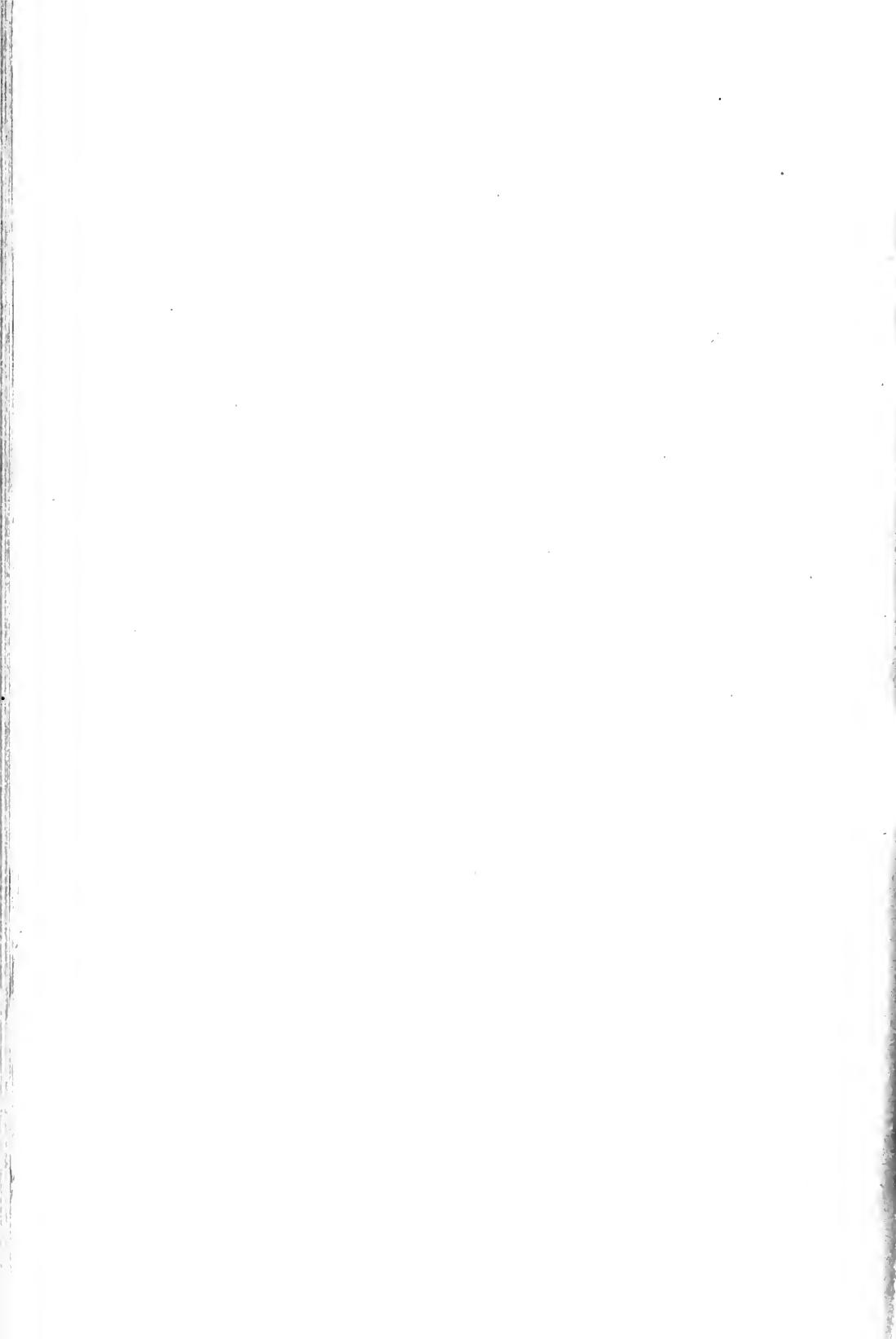


FIG. 4 (Case 1).—Glioma of Optic Nerve, Mixed Type, Showing Vacuolation of Cells and Formation of Large Cystic Space Filled with Serum. $\times 55$.



ILLUSTRATING DR. F. H. VERHOEFF'S ARTICLE ON "PRIMARY INTRANEURAL TUMORS (GLIOMAS) OF THE OPTIC NERVE."



FIG. 5 (Case 2).—Glioma of Optic Nerve, Spindle-Cell Type, Showing Neuroglia Fibrils Stained Differentially. $\times 180$.

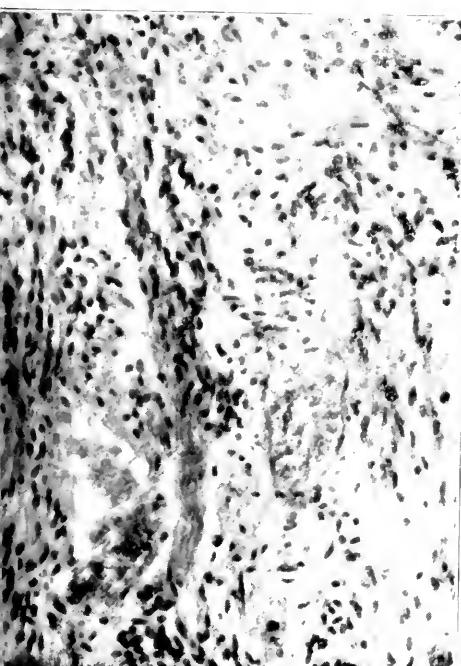


FIG. 6 (Case 4).—Glioma of Hypophysis Cerebri. Neuroglia Fibrils are Abundant but do not Show Well in the Photograph. Vacuolarization of the Cells and Formation of Cystic Spaces are Well Marked. $\times 200$.

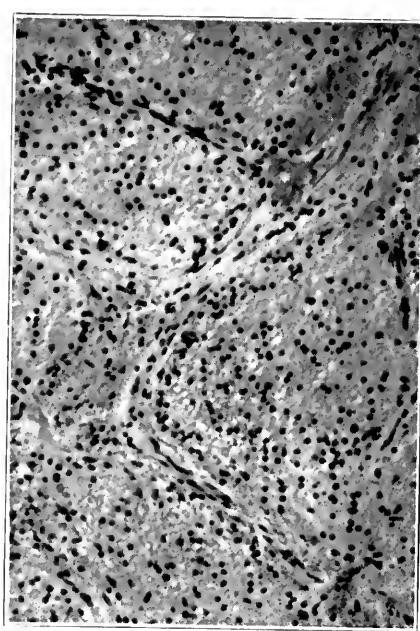
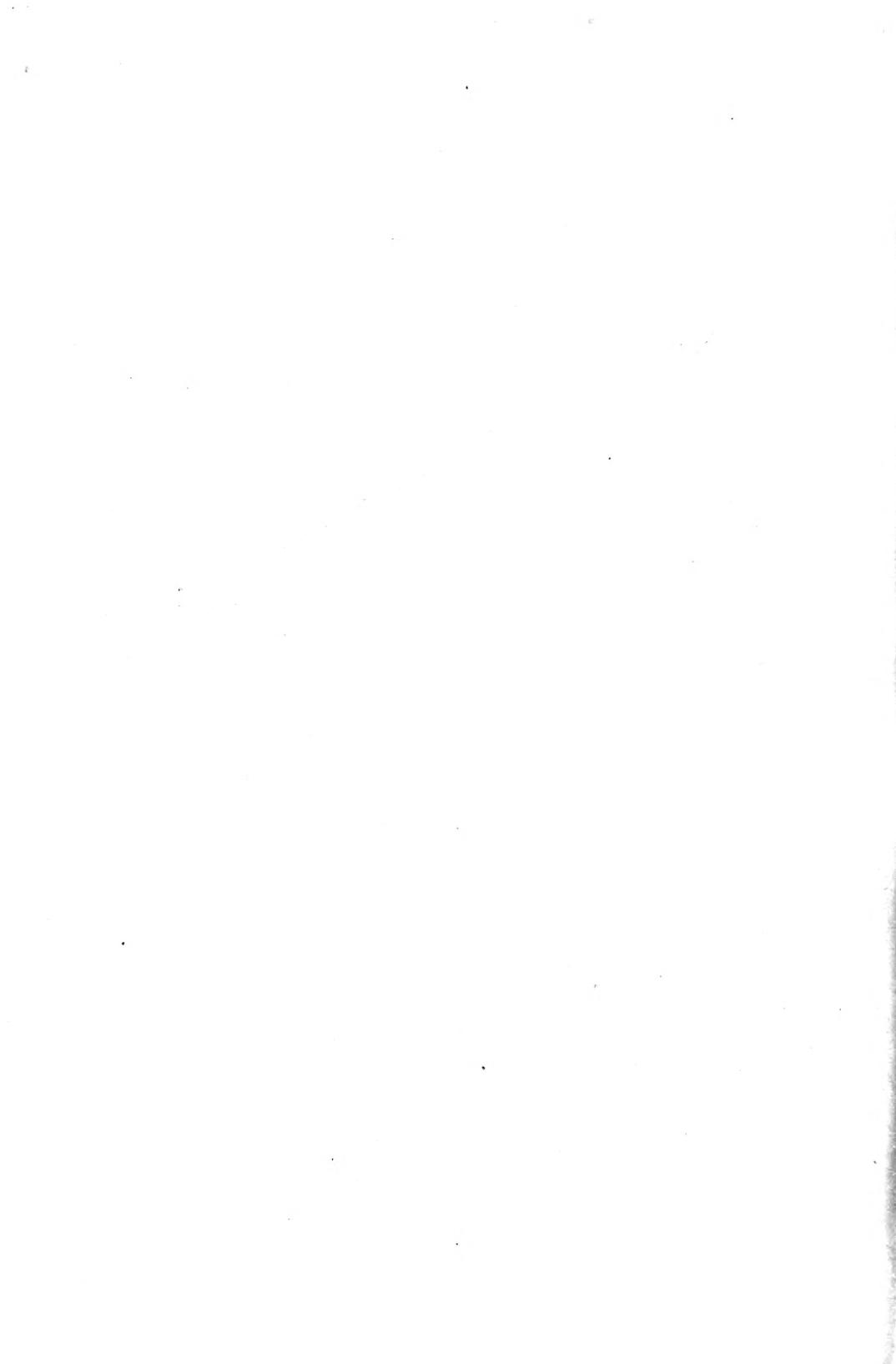


FIG. 7 (Case 6).—Paraffin Section of Glioma of Optic Nerve, Finely Reticulated Type, Showing Vacuolated and Reticulated Structure. $\times 150$.



ILLUSTRATING DR. F. H. VERHOEFF'S ARTICLE ON "PRIMARY INTRANEURAL TUMORS (GLIOMAS) OF THE OPTIC NERVE."

For the drawings (FIGS. 9 to 12) I am indebted to Dr. H. H. Vail. Unless otherwise stated, the staining is in hematoxylin and eosin.

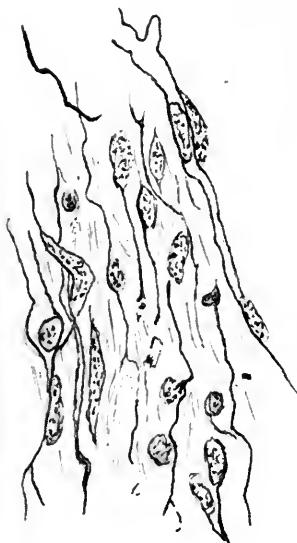


FIG. 9 (Case 1).—Glioma of Optic Nerve, showing Neuroglia Fibrils Stained Differentially, and Spindle Cells.

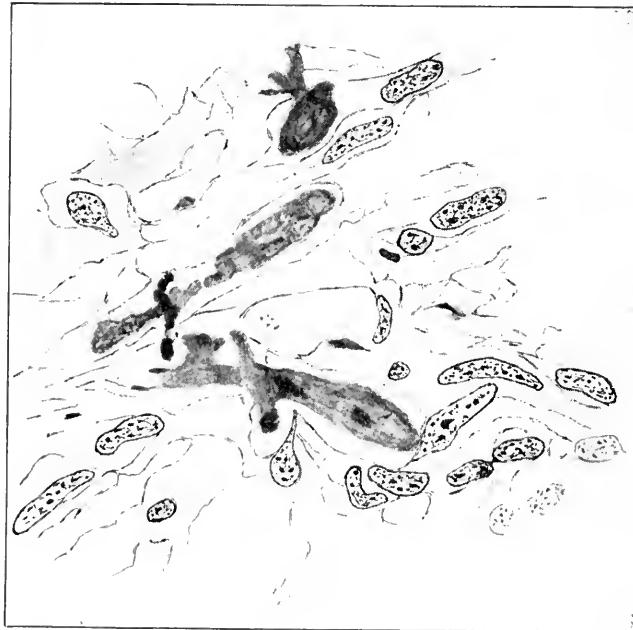


FIG. 10 (Case 1).—Glioma of Optic Nerve, Showing Cytoid Bodies and Vacuolated Syncytium.



FIG. 11 (Case 1).—Cytoid Bodies and Fibrils, Stained in Phosphotungstic Acid Hematoxylin.

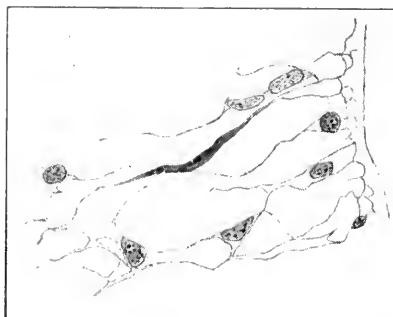


FIG. 12 (Case 1).—Formation of Cytoid Body in Neuroglia Syncytium within the Retina

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ILLUSTRATING DR. EDWARD B. HECKEL'S ARTICLE ON "NON-SURGICAL TREATMENT OF MALIGNANT EPIBULBAR NEOPLASMS."

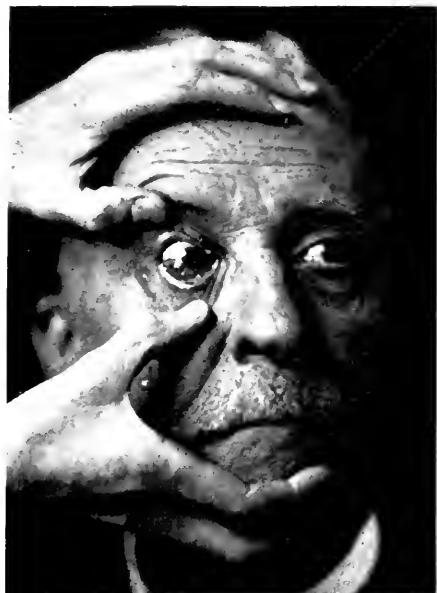


FIG. 1.—A. L. R., at 71 years.
Epidermoid Carcinoma.

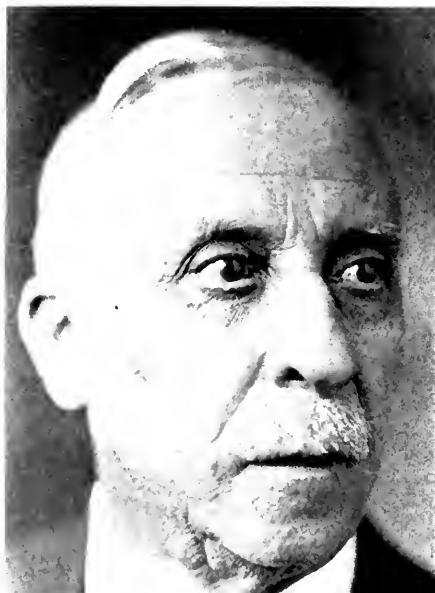


FIG. 6.—A. L. R., same as Fig. 1.
After Treatment.

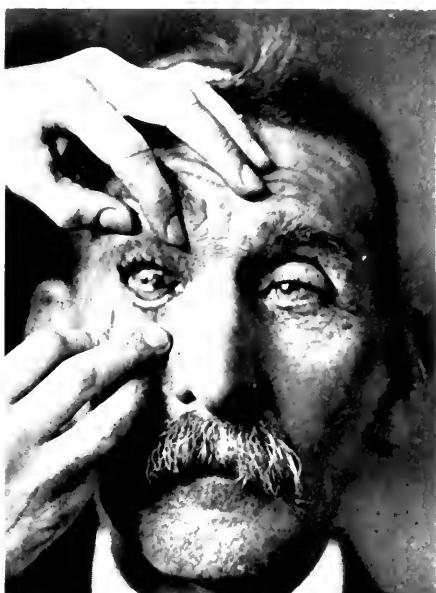
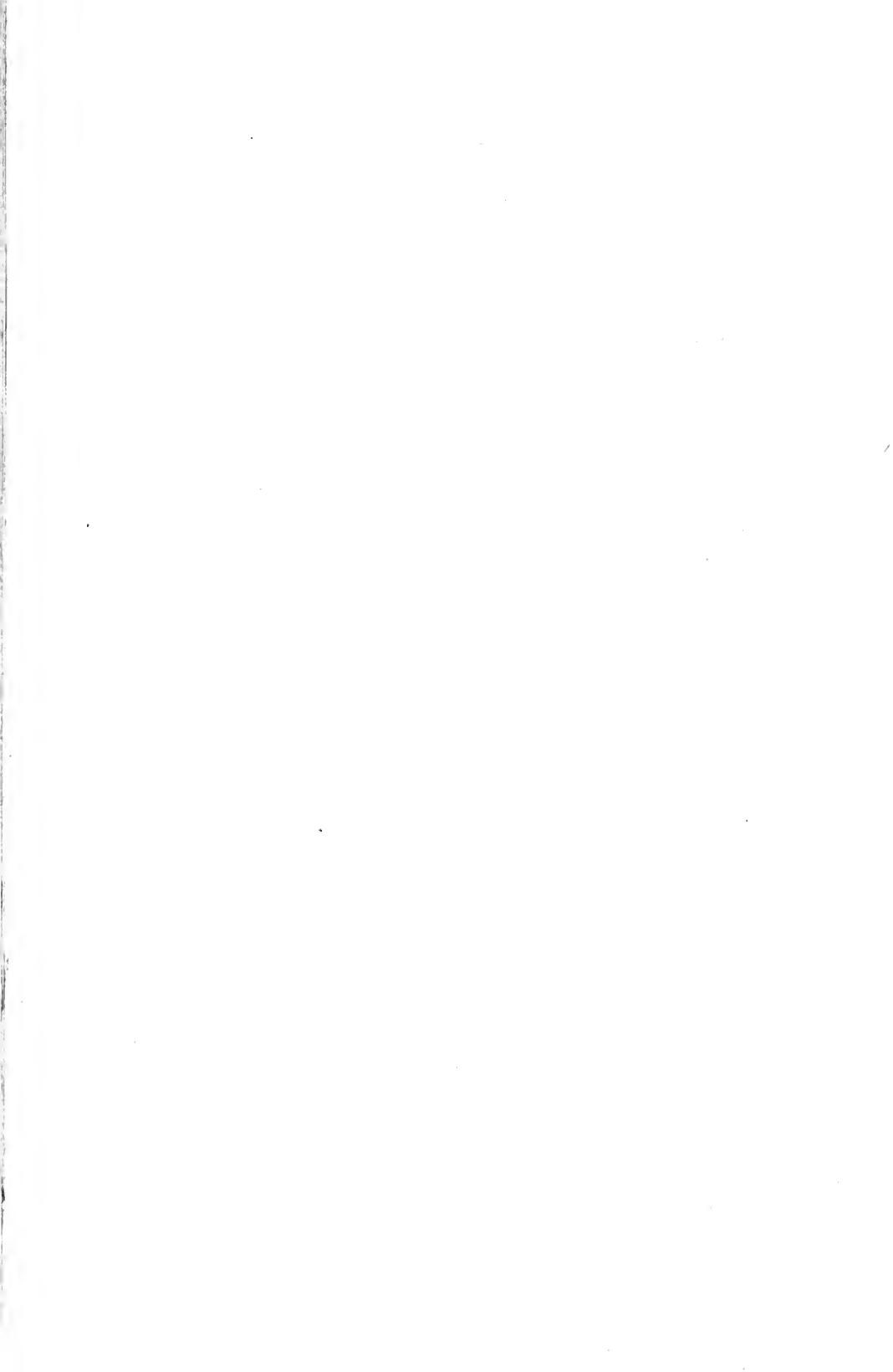


FIG. 4.—G. W. S., at 61 years.
Squamous Cell Carcinoma.



FIG. 7.—G. W. S., same as Fig. 4.
After Treatment.



ILLUSTRATING DR. EDWARD B. HECKEL'S ARTICLE ON "NON-SURGICAL TREATMENT OF MALIGNANT EPIBULBAR NEOPLASMS."

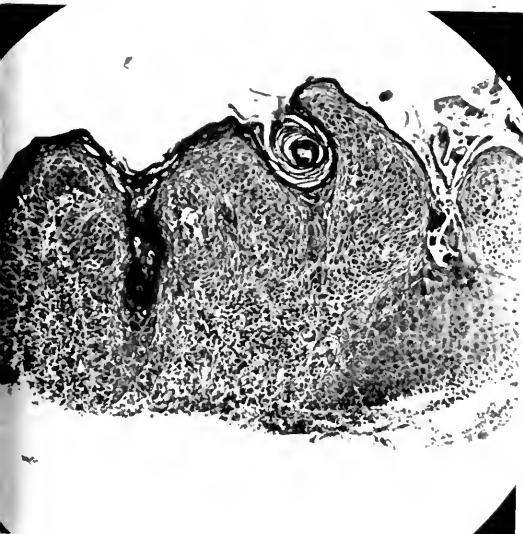


FIG. 2.—Early Epidermoid Carcinoma, Junction of Cornea and Sclera. Zeiss Obj. A A.

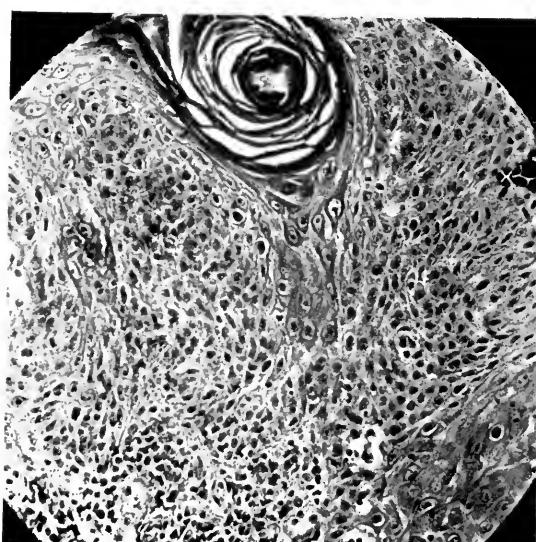


FIG. 3.—Epithelial Pearl and Infiltration of Epithelial Mass. Zeiss Obj. dd.

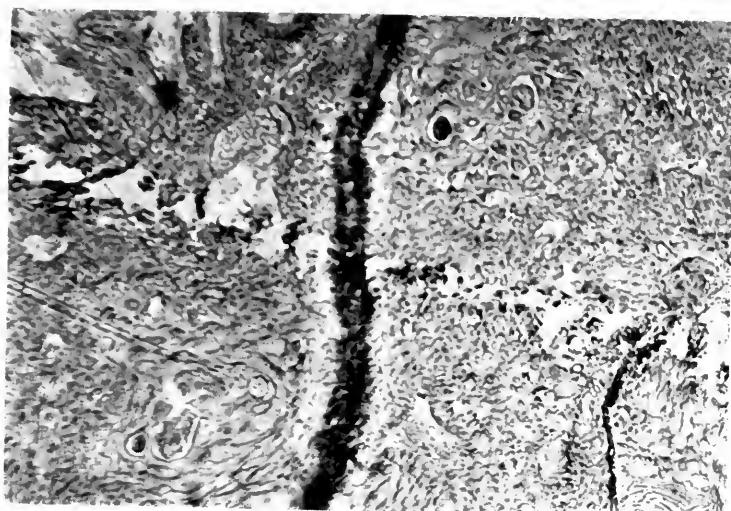
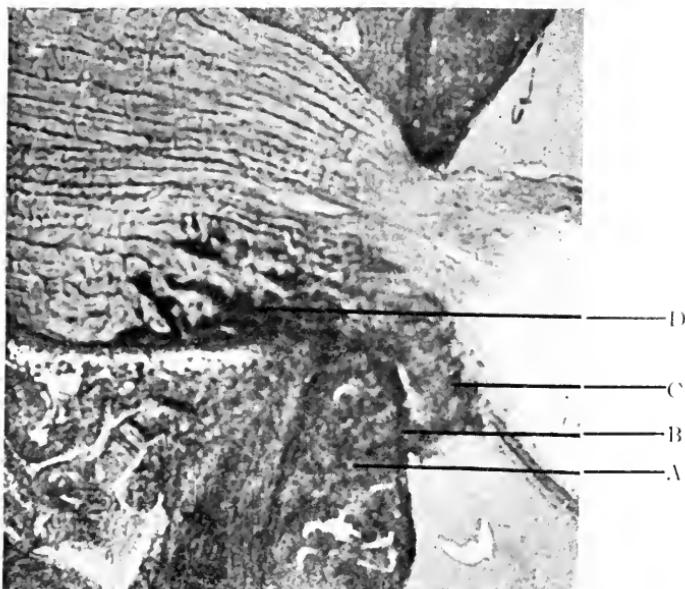


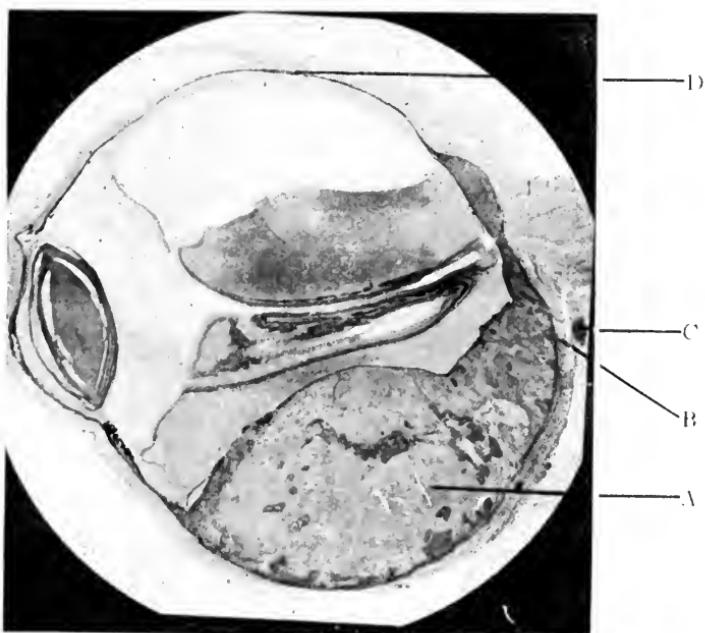
FIG. 5.—Squamous Cell Carcinoma of Conjunctiva; Numerous Canceroid Pearls of the Ingrowth.



ILLUSTRATING DR. J. A. MACMILLAN'S ARTICLE ON "A CASE OF METASTATIC CARCINOMA OF THE CHOROID."



- A. Tumor of choroid.
- B. Point where cells have broken through Bruch's membrane.
- C. Cancer involvement of retina.
- D. Cancer involvement of optic nerve.



- A. Large tumor.
- B. Posterior ciliary vessels with perivascular involvement.
- C. Extraocular nodule.
- D. Small tumor in choroid on nasal side.

ILLUSTRATING DR. HARRY S. GRADLE'S ARTICLE ON "THE USE OF THE GULLSTRAND SLIT LAMP."

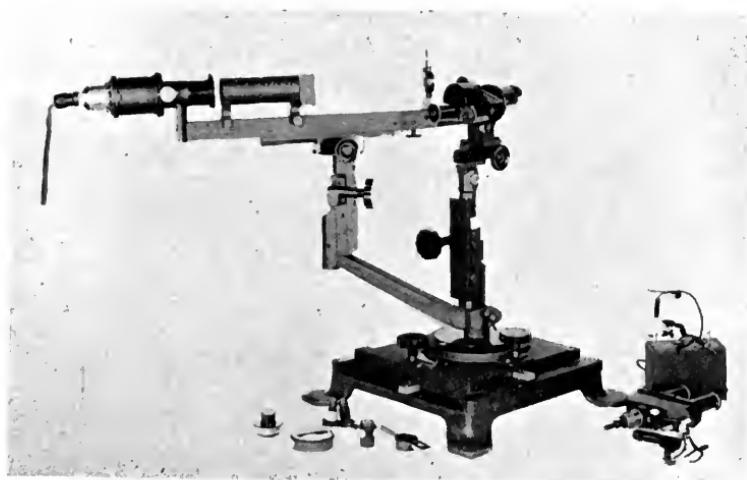
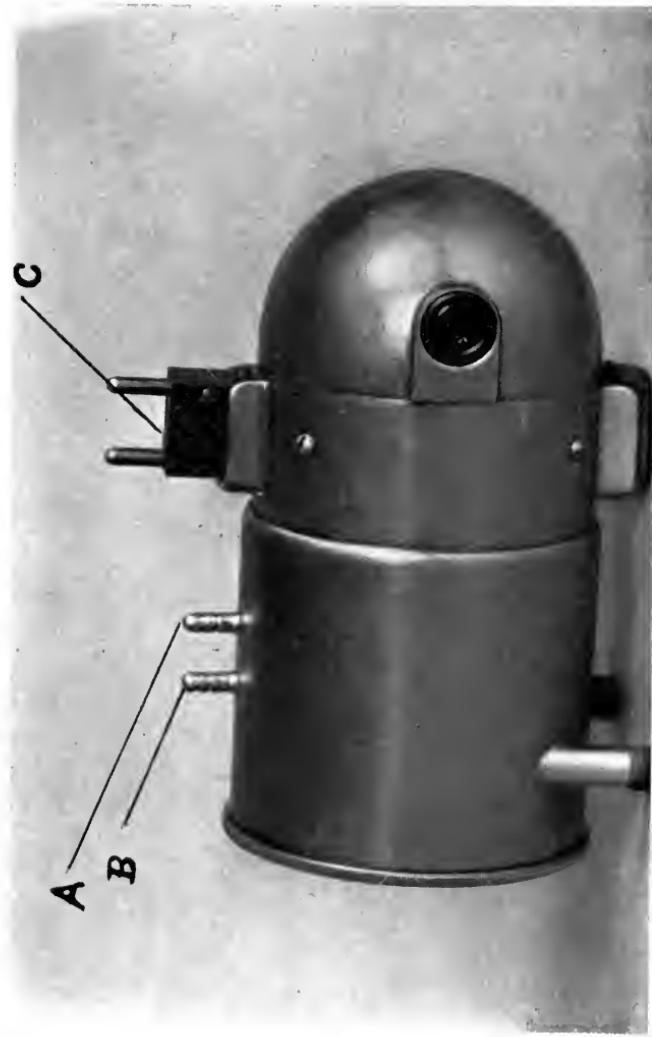


FIG. I.

ILLUSTRATING DR. A. S. AND L. D. GREEN'S ARTICLE ON "THE INTRACAPSULAR EXRESSION
EXTRACTION OF CATARACT."



Electric Motor Pump—Size $6\frac{3}{4} \times 3\frac{1}{4}$ inches.

- A. Connects with tube leading to foot valve.
- B. Air outlet.
- C. Electrical connection.

ILLUSTRATING DRs. A. S. AND L. D. GREEN'S ARTICLE ON "THE INTRA-CAPSULAR EXPRESSION EXTRACTION OF CATARACT."

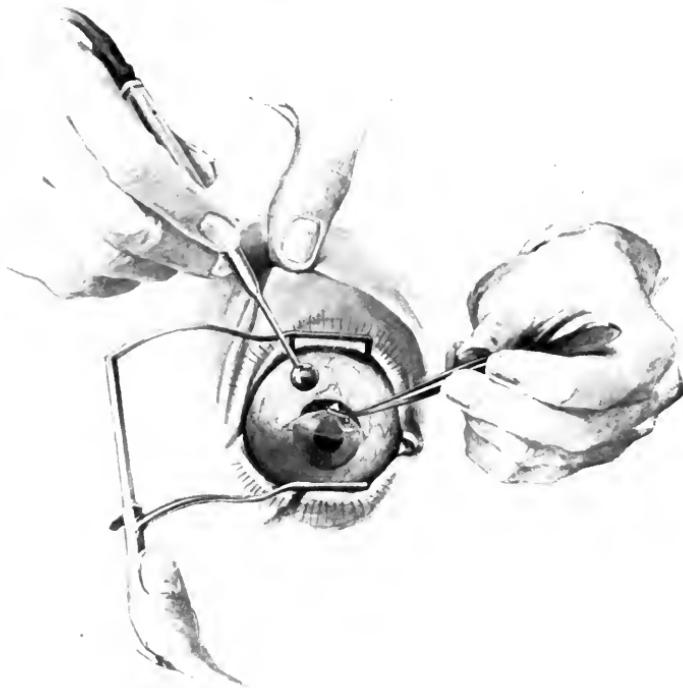


FIG. 4.—Conjunctival flap grasped with pressure forceps in the left hand, while the canula is being introduced with the right hand.

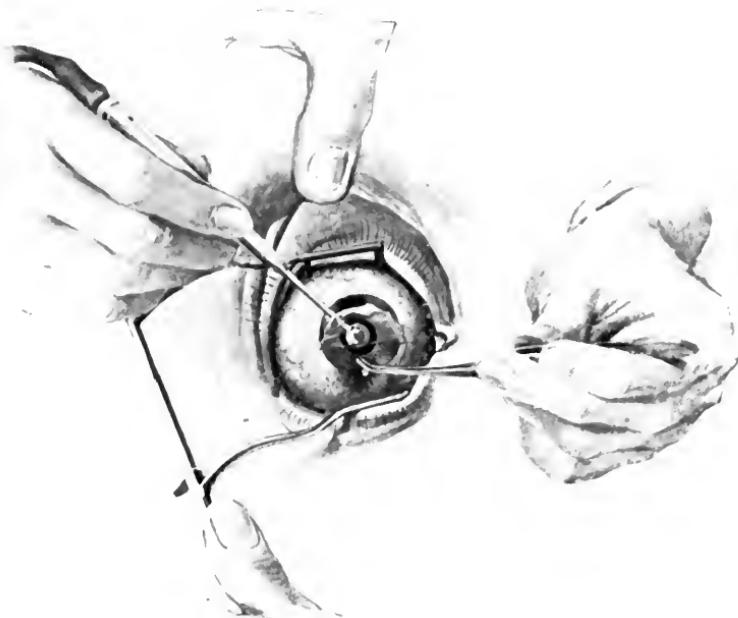


FIG. 5.—Pressing on the limbus with the ball of the forceps, as the cataract is being extracted.

ILLUSTRATING DR. ELLIOT'S ARTICLE ON "THE FILTERING SCAR."



Photo by E. E.

FIG. 1.—A meridional section through the fistula and the filtering scar. The ciliary body is entangled in its depths; it will be observed in Fig. 1 that the surgeon who performed the operation trephined rather far out, and so lost some of the advantage gained by the splitting of the cornea. The fistulous passage is in free communication with a widely open subconjunctival filtering space. The tissue in both cases is made up of extremely loose connective tissue, very poor in cells, and enclosing a large number of open spaces, which are nowhere lined by endothelium.



Photo by E. E.

FIG. 2.—The scleral fistula on a larger scale (from Fig. 1). To the left upper corner of the figure is the communication between the fistula and the subconjunctival filtering scar.

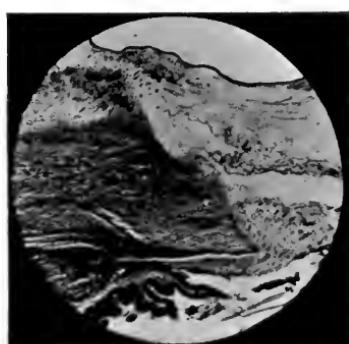


Photo by E. E.

FIG. 3.—The scleral wall of the fistula shown in Fig. 1. The membrane of Descemet can be clearly seen sharply cut across on the edge of the fistula. On tracing it to the left, hyaline excrescences are seen on its surface; farther still to the left, it breaks up to form the pectinate ligament.

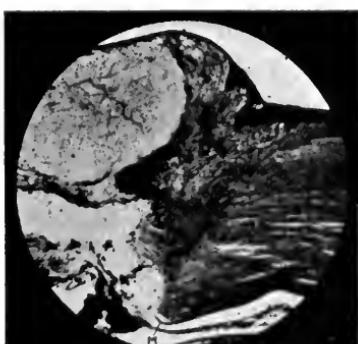
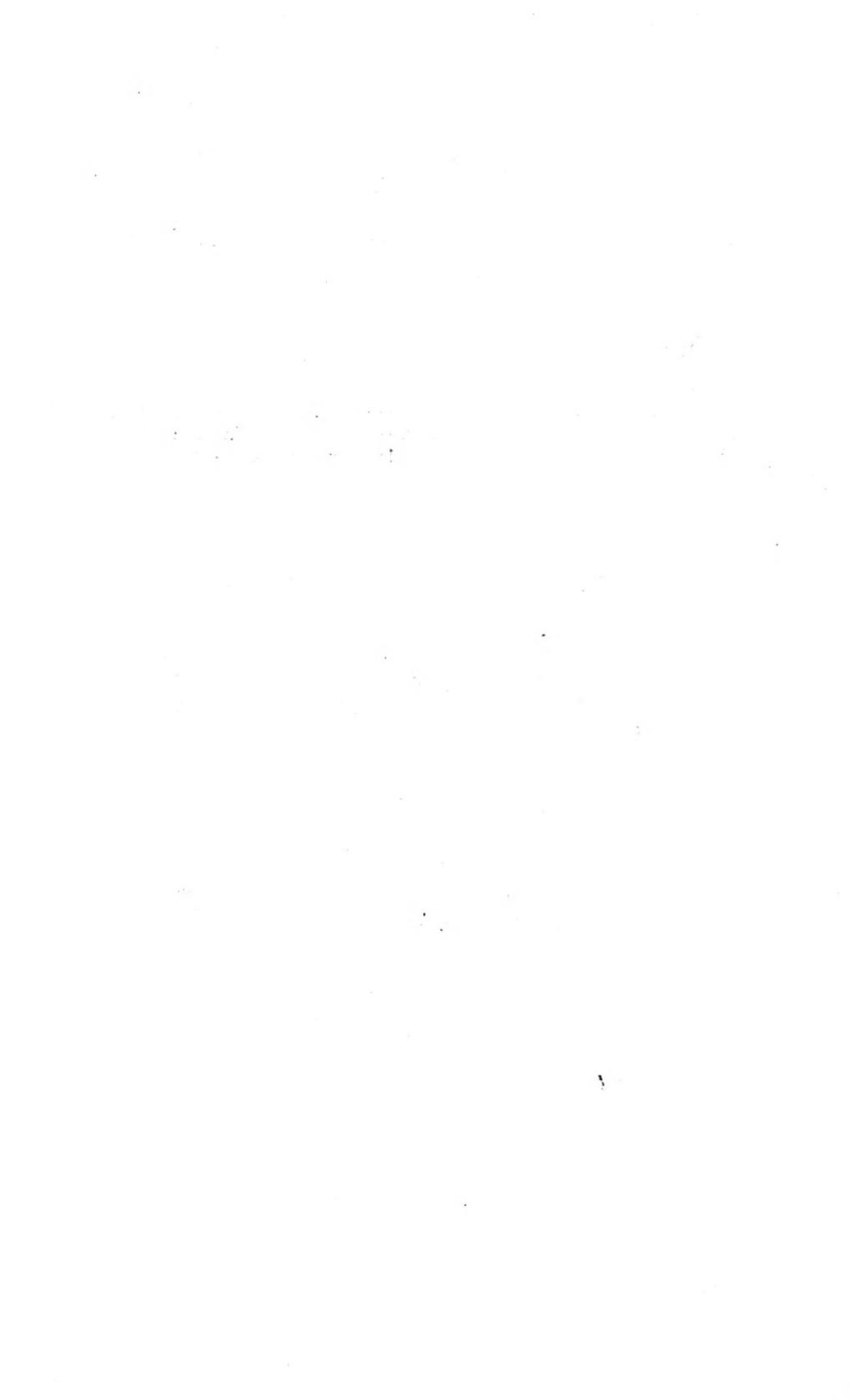


Photo by E. E.

FIG. 4.—The right hand wall of the fistula shown in Fig. 1. Notice the thinning of the surface epithelium over the filtering scar, and the membrane of Descemet cut off short in the depth of the wound. *M*, Cut end of Descemet's membrane.



ILLUSTRATING DR. ELLIOT'S ARTICLE ON "THE FILTERING SCAR."

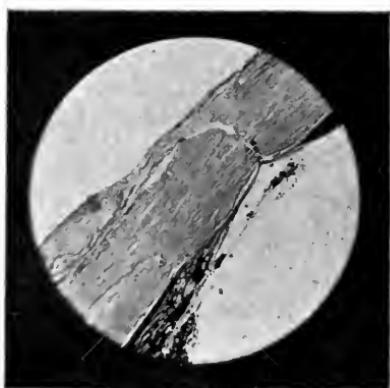


Photo by E. E.

FIG. 5.—A scleral fistula, the result of the couching of a lens for cataract; the ciliary body is impacted in its deepest part, and there is a spongy scar on its conjunctival surface.



Photo by E. E.

FIG. 6.—The conjunctival spongy scar of the previous figure highly magnified to show the open spaces.

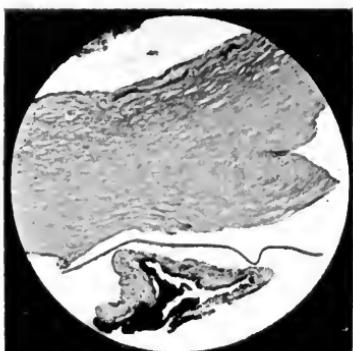


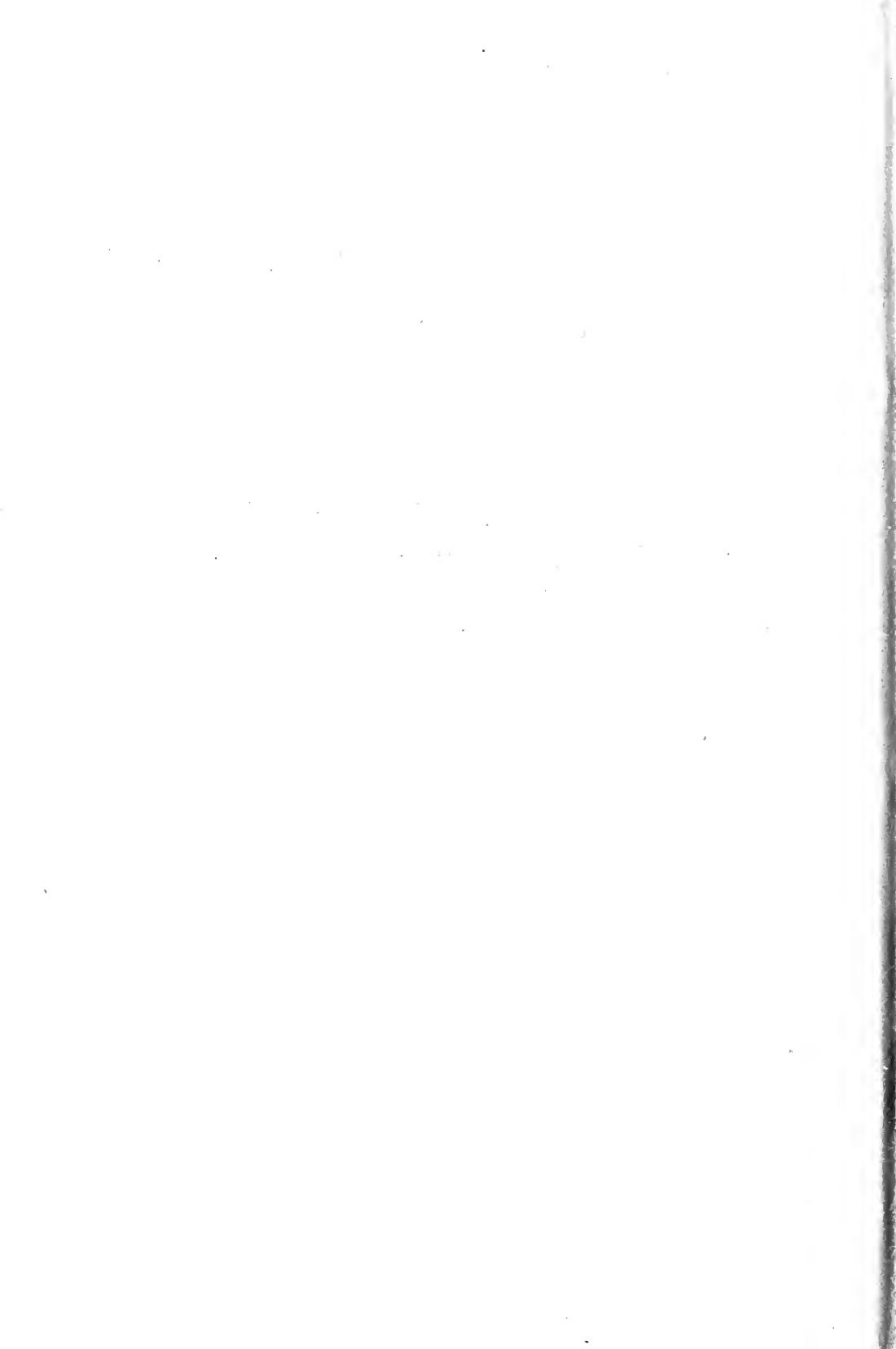
Photo by E. E.

FIG. 7.—A trephined disk covered throughout by Descemet's membrane which has become detached from its base owing to shrinking during the preparation and to the act of cutting. Notice on its deep surface to the left-hand side of the figure (the scleral end) the wart-like excrescences due to deposits of hyaline material. Beneath the membrane of Descemet is seen the knuckle of iris which was cut off by the same snip of scissors that divided the hinge of the disk.



Photo by E. E.

FIG. 8.—A trephined disk on the deep surface of which some layers are seen folded back at right angles. These consist of a few of the deep lamellae of the cornea, and below this again of Descemet's membrane, with hyaline thickenings on its posterior surface. This membrane can be seen to break up into the pectinate ligament which lies to the left. Deep to this again, on the extreme left of the specimen, is a small portion of the knuckle of iris, which was removed at the same time as the disk.



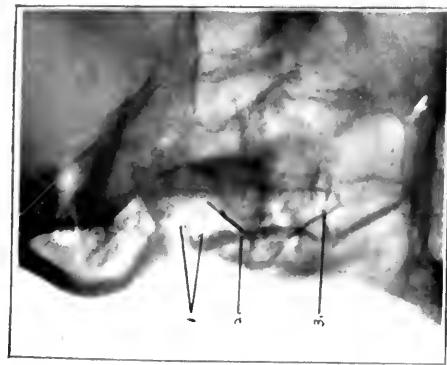


FIG. 1.—NORMAL PASSAGEWAYS.

(1)—Upper and lower canaliculi entering the sac separately (the exception to the rule).

(2)—Silver rider over the root of the middle turbinate, showing the passageways just anterior to this structure. The rider also marks the lower end of the sac in this case.

(3)—Showing the course of the bismuth and the narrowing of the lumen of the duct as it enters the inferior nasal meatus. (The greatest constriction is not at the junction of the sac and duct as is usually stated.)

Case No. 25358—*Mr. T. H.*

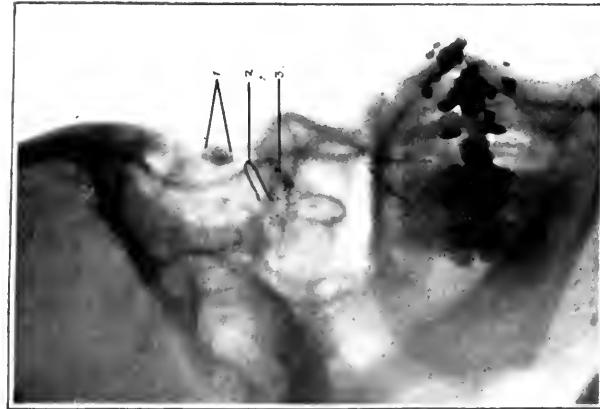


FIG. 2.—COMPLETE OBSTRUCTION.

(1)—Lacrimal sac with complete obstruction at the lower end.

(2)—Silver rider over root of the middle turbinate.

(3)—Bismuth stripe on anterior end of the middle turbinate.

Note.—The obstructed sac is well above and just anterior to the turbinate, a point of value when operating intranasally. It is difficult to see why the anterior end of the middle turbinate should be removed in any operation on this sac.



FIG. 3.—OPERATED CASE WITH SATISFACTORY DRAINAGE.

(1)—Upper and lower canaliculi.

(2)—Cupido (upper limit of sac).

(3)—New opening made from sac into middle meatus. This is well placed and of a good size.

(4)—Bismuth in the right nasal passage.

(5)—Point of obstruction.

Case No. 27809—*Mr. R. C.*

Case No. 31048—*Mrs. M.*

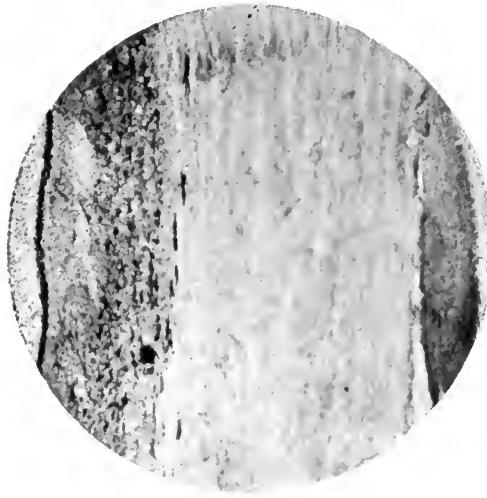


FIG. 1.
Sympathetic ophthalmia. Low power showing diffuse thickening of choroid.



FIG. 2.
- Sympathetic ophthalmia. High power.

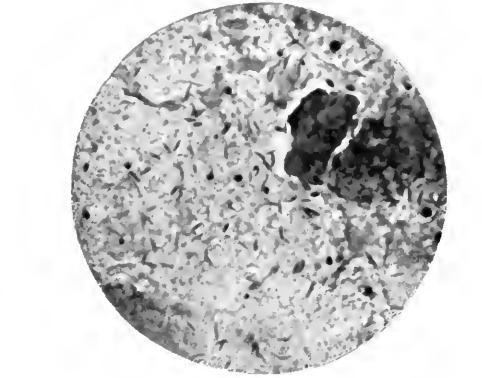


FIG. 3.
Normal guinea-pig. Impression of choroid showing fusiform bodies.



ILLUSTRATING DR. GIFFORD'S ARTICLE ON "OCULAR SPOROTRICHOSIS."



FIG. 1.—Case I at time of first visit.



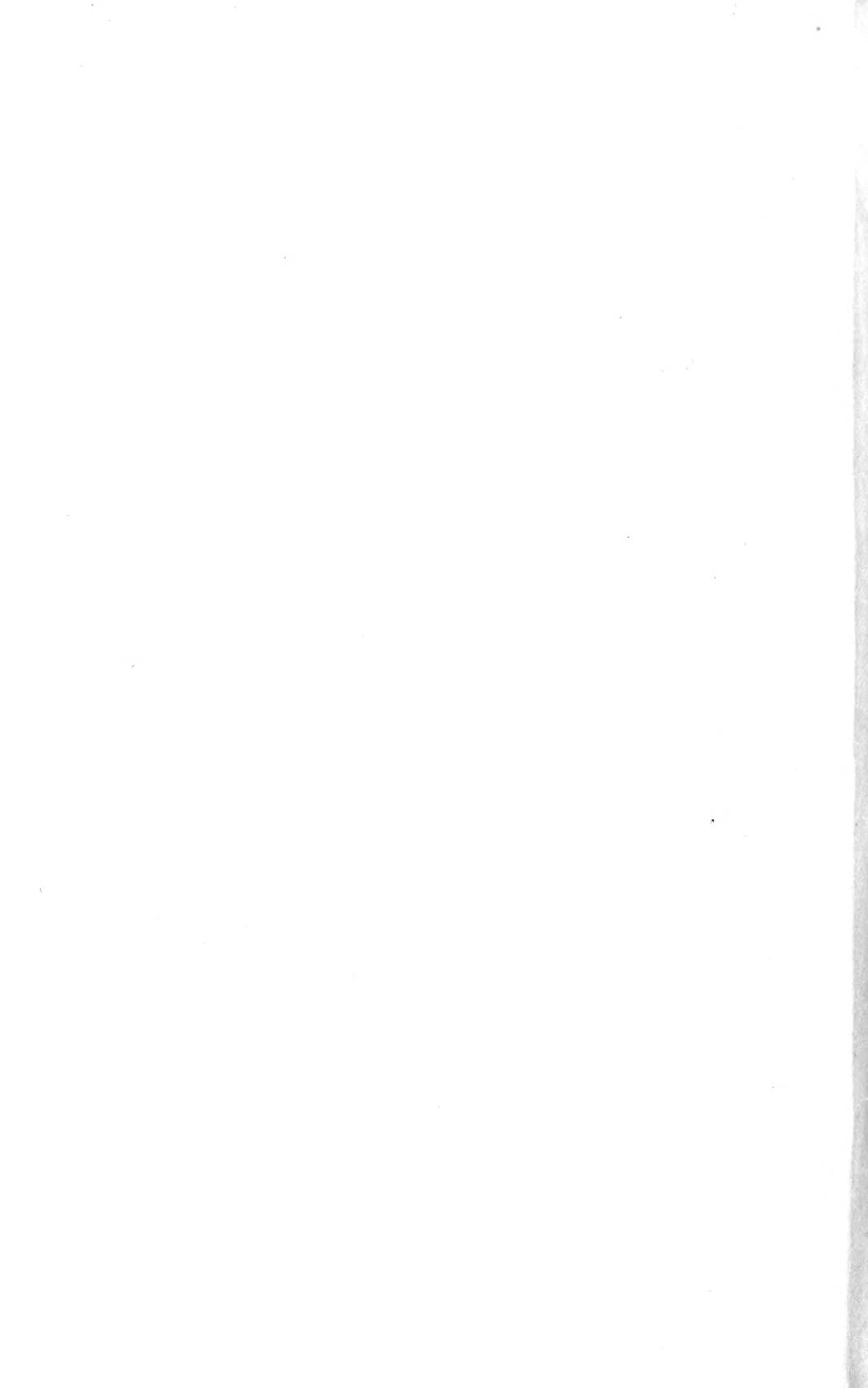
FIG. 2.—Seven day culture from Case I.



FIG. 4.—Case III.



FIG. 3.—Hanging drop photograph of culture in Case I.



ILLUSTRATING DR. FREDERICK H. VERHOEFF AND DR. JONAS S. FRIEDENWALD'S ARTICLE ON
"BLEPHAROCHALASIS."



FIG. 1.—Blepharochalasis.

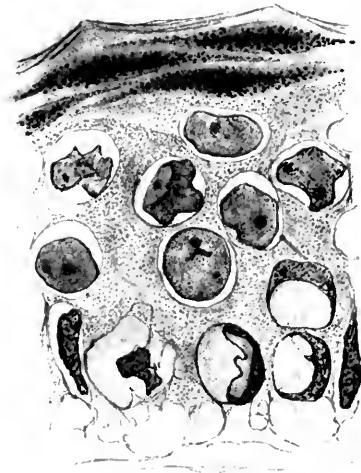


FIG. 3.—Epithelium under high power showing marked vacuolization and the basal changes. Magni. x 970. Haematoxylin and eosin.

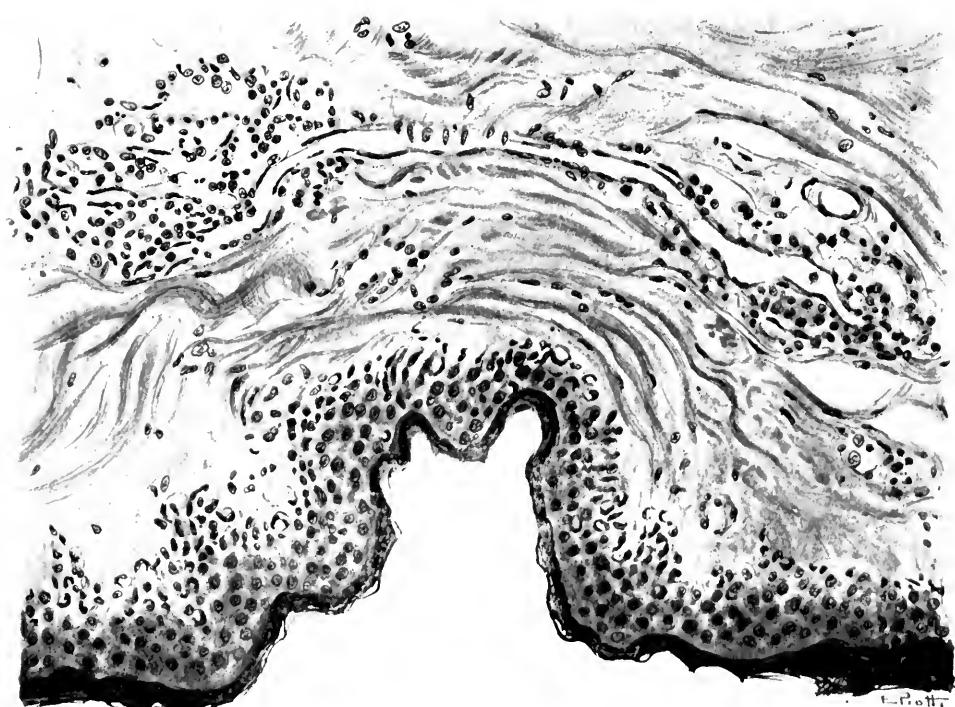


FIG. 2.—Showing changes in inner layers of epithelium, the loose arrangement of the fiber bundles of the corium, and the proliferation of the endothelium at two areas along the course of a venule. The formation of capillaries in these areas can be recognized. Magni. x 375. Haematoxylin and eosin.

ILLUSTRATING DR. L. W. CRIGLER'S ARTICLE ON "A SIMPLE OPERATION FOR PTERYGIUM."

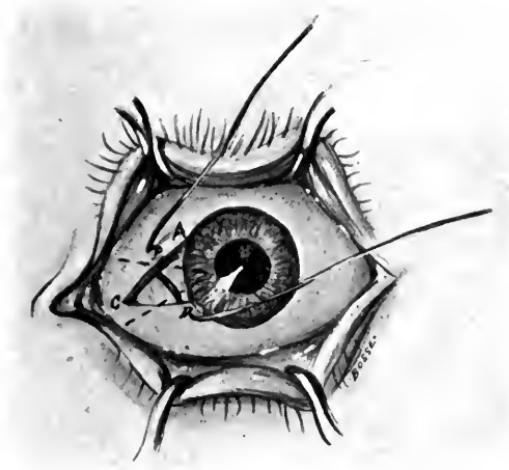


FIG. 1.

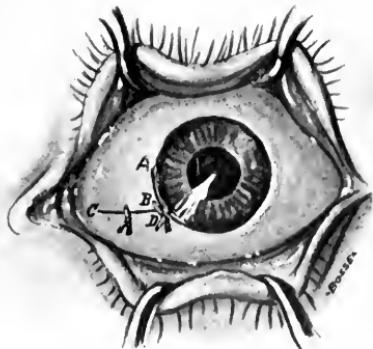


FIG. 2.





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